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THE DISASTER AT SAN FRANCISCO.

Along with every other industry the electrical fraternity has suffered a severe financial loss through the earthquake and conflagration which overwhelmed San Francisco, Cal., last week. The telephone and telegraph, electric light and power, and street railway companies alike suffered to an enormous extent.

San Francisco has happily an electrical supply more than large enough to satisfy all its demands available from the hydro-electric power stations situated in the hills, no report of damage to any of which has come to hand as yet. In rehabilitating the electrical service the matter will be simplified, as all that will be necessary will be the restoration of the low-tension distributing system supplied by substations.

Finally, it is only right that a note of praise be sounded for those loyal servants of the public, the telegraph operators, who, driven from post to post by the shock of the earthquake and the advance of the conflagration, maintained lines of communication from the very beginning of the disaster, when the lines were temporarily disabled, working night and day until the complete restoration of service was possible.

M. PIERRE CURIE.

By the accidental death of M. Pierre Curie, who was killed in Paris, Thursday, April 19, the scientific world loses one of its foremost experimentalists. No discovery in science of recent years has attracted more widespread attention than that of radio-activity, and with this work the names of Professor and Mme. Curie are inseparably connected. Attracted by Becquerel's announcement of photographic action, produced apparently by some agent other than light, they threw themselves enthusiastically into the investigation of this phenomenon. Although hampered by lack of means, their great skill in research work and their unquenchable enthusiasm brought forth results of the utmost importance. They not only separated from that complex mineral, pitchblende, the radioactive material, but they differentiated between several constituents, and presented the chemical world with two new elements. This was a mighty accomplishment, but to the scientific it is overshadowed by their announcement that radioactive materials continually give out energy. This announcement, when made, seemed contrary to a fundamental law of physics, and although later work seems to have brought the new discoveries into accord with physical law, it has been at the expense of chemical theory.

These results, although the more striking, by no means represent all that Professor and Mme. Curie have accomplished, for through their indefatigable labors constant advance was made in the new branch of science and important facts reported at frequent intervals. Undoubtedly, much more work would have been accomplished had he been spared, for he was only at the height of his career. The world has therefore suffered a severe loss, for men with his rare combination of experimental skill and patience can ill be spared.

It is a noteworthy fact that in spite of the important work done by Professor and Mme. Curie, their name is connected with radioactivity only by association, and not directly. Their modesty led them to find in other ways names for the new elements, and the scientific world has followed their lead. It is to be hoped that ere long some appropriate way of commemorating the work of this great man will be found.

UTILIZING NATURAL ENERGY.

An interesting article on the utilization of natural energy is contributed by Dr. Louis Bell to *Cassier's Magazine* for April. In this Dr. Bell discusses our fuel resources, calling attention to the rate at which they are being exhausted, and then examines the country to determine the relative values of different sections with respect to other sources of power. The first of these to be considered is water power, of which there are five regions: that of the New England states, the Appalachian region, which embraces the section of the country traversed by the Allegheny and Blue Ridge mountains; the upper lake region, to the south and west of lake Superior; the Rocky mountain region, which, however, is rather uncertain as to its importance and its size; and the Pacific coast region, a section which has already been fairly well developed. The importance of these different regions varies not only as regards its location to industrial centres, but with the topography of the ground and with the annual rainfall. In the latter regard the Appalachian power area is particularly fortunate, while the New England area is, in general, of a character making development more easy.

Dr. Bell then calls attention to a phase of the problem not generally appreciated: wherever there is an elevated area there is always a possibility of impounding the rainfall, and in this way creating a source of power. For example, an area of one acre stored one foot deep with water which is utilized by wheels having an efficiency of eighty per cent will produce about 1.1 horse-power-hours for each foot of available head; therefore, a 1,000-acre pond stored ten feet deep, with an effective head of 500 feet, will make available 5,500,000 horse-power-hours—about 1,800 horse-power steadily for a working year of 3,000 hours. In order to store the water ten feet deep a considerable watershed is required, diminishing, however, in area with the increase in the rainfall; but a good allowance must be made for seepage and evaporation. The southern Appalachian region, on account of its heavy rainfall and the mountainous country, is particularly suitable for developments of this character. Assuming that one-half the rainfall goes into storage, and allowing a rainfall of forty-eight inches, requires 5,000 acres of watershed to fill the 1,000-acre pond. Allowing, however, for evaporation and seepage would make it advisable to double the area of the watershed; but generally land in the mountains is cheap, so that this item would not be very great. It is interesting to note that there is at the present time in Vermont a water power of this kind which corresponds approximately to the figures just mentioned. The pond has an area of 800 acres and the drainage area is about 10,000 acres.

Another source of power which can be utilized practically is sunshine. This is particularly valuable in the West where rains are few and the country flat. About 100 square feet of reflecting surface is in general required to develop one horse-power, and already equipments of this kind with an output of ten horse-power have been erected for irrigating purposes.

The wind is another available source of power, and will probably be used more and more in country districts. Unfortunately, the variable character of the wind interferes with its most effective development. The average velocity is low, so that large wheels are required if the output is to be considerable; but a large wheel is very liable to damage or even destruction during a storm. Winds can not be considered as reliable sources of power unless some means of storing energy be added.

Two other sources of power are mentioned. These are the tides and the waves. The latter have been utilized in one or two cases, but can not be considered important. The difficulty in utilizing tides is due to the fact that they are not available continuously, but only periodically, and in order to obtain a continuous output large storage basins, involving generally great expense, would be necessary. The most suitable place for such an undertaking is the Bay of Fundy, where the rise is about forty feet; but to dam this inlet would be a stupendous undertaking which we are not yet ready to attack.

Taking into consideration all these sources of power, it is evident that considerable as they are they have their limits. We can not look forward to an inexhaustible power supply, and some day we will reach the limit. This will, of course, happen after our enormous coal supplies have been exhausted, but when that day comes Dr. Bell sees no help for us except a migration toward the warmer regions of the country. It is worth recalling that by far the greater part of our fuel to-day is used purely for heating purposes and not for power. It may also be mentioned that in general the energy which we utilize in nearly all processes eventually escapes as heat, and if we could save and store this heat for use as needed, this would be getting a double service out of our power supplies and thus, in effect, increasing their output.

LAMP FIXTURE IMPROVEMENT.

At a recent meeting of the Illuminating Engineering Society the statement was made that the manufacturers of lamps and shades would have to do the best they could with the outlines of the fixtures adopted by the makers of the latter. To this Mr. E. L. Elliott replied that the argument was wrong in principle; that since the fixture was primarily to support lights, it should first of all be a mechanical device, and, secondly, decorative; therefore the fixture should be designed, first, to give satisfactory service, and then it may be made beautiful. A principle laid down by Ruskin is that useful devices may be made artistic, but mere decorations should never be made useful. One occasionally comes across lighting fixtures showing no reason for their design, unless it be an outline handed down from some old gas chandelier, and which are miserably adapted for supporting incandescent lamps; and this is the stranger since little effort seems to have been made to take advantage of the opportunities offered by this lamp. Of course, exceptions are seen occasionally. Indeed, some very beautiful electroliers were exhibited at the St. Louis Exposition. There is no other illuminating agent which offers such freedom in design. There is no necessity to place the lamps just so, no flame to be avoided; in fact, so far as the fixture itself is concerned, the lamp is almost ideal. It remains for those who construct these accessories to give us something useful and beautiful, something more than a mass of brass and glass.

A POSSIBLE APPLICATION OF THE ZEEMAN EFFECT.

An instructive lecture was delivered recently before the Royal Institution, of London, by Professor P. Zeeman, whose name is connected with an important discovery in physical optics. The first work in this branch of physics was done by Faraday in 1845, when he showed that the plane of polarization of light is rotated by a magnetic field. Faraday, however, was not able to establish any action of the magnetic field upon the source of light, nor could he detect any change in the spectrum lines due to the same cause. It remained for Professor Zeeman, when studying the effect of reflection of light from magnetized iron mirrors, to discover that certain parts of the spectrum are affected by the field. He noticed that the two sodium D lines apparently became broader when a magnetic field was intense. The change was slight, but it was greater than had been expected. By pushing this investigation further Professor Zeeman was able first to broaden the sodium lines to three times their original width, and finally to split up many of the single spectrum lines into doublets, triplets, or even higher numbers. He has also split up in the same way the dark absorption bands of certain vapors, and it is this broadening out and splitting up of the lines of the spectrum by the magnetic field which is known as the Zeeman effect.

A complete explanation of all the phenomena obtained in this field can not yet be given, but the most satisfactory is presented by the electron theory, due to Lorentz. Light is generally admitted to be vibrations of something in a plane at right angles to the direction of propagation. Such vibrations may be rectilinear, or they may be circular, having either of two directions of rotation. Assuming a complex vibration made up of all three of these motions, and the vibrating bodies to be electrons or small particles of matter carrying electric charges, a magnetic field parallel to the ray would act upon them in different ways. Upon those particles oscillating in straight lines it would have no effect. On the other hand, of the two particles, one having a circular vibration to the right and the other to the left, there would be a tendency to accelerate the one and to retard the other. Thus, although the frequency of the three vibrations might have been the same before reaching the magnetic field, after passing through it there would really be three frequencies, slightly differing from one another. A spectrum line due to such vibrations would therefore be split up into three separate lines after passing through a magnetic field, provided, of course, the field was sufficiently intense and other conditions were suitable. This explanation, however, does not account for all of the phenomena, though further research will doubtless aid much in explaining obscure points.

So far the work has been purely scientific, no practical value having been derived; but there is a possibility of utilizing this effect, as was pointed out during the lecture. The degree of separation of the two or more parts of a line depends, of course, upon the strength of the magnetic field, and hence this means would be very convenient for measuring the intensity of magnetic fields, were it not unfortunately true that the spectroscope is not a convenient instrument for every-day work. A simpler type of instrument might possibly be devised which would meet the requirements. Could this be done, a valuable tool would be added to the already excellent equipment of the electrical engineer.

RUBBER INSULATION.

The wonderful mechanical and electrical properties of rubber places it in a unique position in the mechanical and electrical industries. For certain uses no material has been found which can take its place, and, unfortunately, the uses for it are increasing more rapidly than is the supply, hence it is becoming more and more necessary to find a material which can take its place for certain purposes. The present situation is discussed very clearly in the *India Rubber World* (New York) for April. Stress is laid upon the importance of using rubber only where it is essential. Some years ago when rubber was the only high-grade insulating material available adulterants were largely used to produce a cheap insulation, but these were unsatisfactory. What is needed is not a substitute rubber, but a substitute for rubber. A little later it was realized that for certain purposes, such, for example, as high-tension conductors which are laid in conduits underground, although rubber was an excellent material, it was not necessary, since dielectric strength could be obtained in other ways, and the mechanical properties of rubber were of no particular advantage. This led to the introduction of paper-insulated cables, which have so greatly reduced the cost of underground transmission lines and relieved the rubber supplies of a very considerable drain. Practice has also changed in the construction of high-tension lines with the increase in pressure. It was soon realized that when one goes to 20,000 or 40,000 volts an insulating covering on the wires is of no particular value; in fact, it may become a source of danger to life, so that it is not only cheaper, but better to use bare wires wherever this construction does not add to the danger of neighboring conductors. For interior house wiring, however, rubber insulation is of great value, and it will probably be demanded for some time to come. To supply this one field of the electrical industries alone puts a severe burden upon the rubber industry.

Although the electrical industries have, in a sense, decreased the demand which they made for rubber insulation, the demand in other lines of work has increased so rapidly that an increase in the supply is very urgently needed. It is to be hoped that the large rubber plantations which have been started during the last few years will soon begin to give favorable accounts of themselves. Artificial substitutes have not yet been satisfactory, but there is no reason why we should yet give up hope of relief in this direction. It is a problem for the chemists, and one well worthy of more attention. Sources of rubber other than those now depended upon have been sought in many countries, and occasionally success has been reported; but further trial has generally led to disappointment. As the necessity for relief becomes the more urgent the endeavor to supply it will be greater, and it is to be hoped will be successful.

Advance in Electrical Work Lessens the Fire Risk.

Mr. C. J. H. Woodbury, Boston, Mass., in an address before the Profite Club, an organization of insurance men, in Manchester, N. H., on the subject, "Electrical Fire Hazard," recently said:

The early installations of electric lighting plants, whose circuits were upon insulated wires with earth return, caused numerous happenings which alarmed the underwriters. An investigation by a technical representative of several insurance companies and by those of the electric lighting interests was held, wherein the various incidents which had been the causes of fires were experimentally repeated, and new methods for the installation of plants were prepared on behalf of the underwriters. It was thus noted at the very inception of the commercial applications of electricity to interior lighting that the hazards could be minimized by arrangements which would improve rather than impair the operative conditions of the plant. The feature of divesting a process of its dangerous elements initiated in a new principle in fire insurance, which has been widely extended in the technical treatment of various hazards, particularly those of manufacturing processes. These electrical rules were extended along the lines of the advance of electrical applications and various technical organizations, municipalities and local boards of underwriters, even individuals and manufacturers, prepared rules whose differences in unessential demands and deficiencies in specifications were sufficient to cause unnecessary vexations and frequent embarrassment, especially to the manufacturing and operative electrical interests.

In March, 1896, the national conference on standard electrical rules assembled in New York for the purpose of preparing a code, embodying specifications covering the conditions of safety in a manner equitable to all the interests involved. The various rules were diligently compared and their provisions criticised, and the reports of these meetings with an extensive correspondence containing suggestions, were referred to a committee which prepared the national electrical code, which was adopted by the national board of fire underwriters and promulgated by them.

It is submitted that this code represents a wider consensus of opinion upon a question of science applied to the service of mankind than was ever given concurrently to any similar question. These rules are anomalous in their functions. They set forth conditions governing methods of construction, installation and operation of electrical plants, and their specifications receive the utmost consideration from those to whom they apply.

The whole foundation of fire insurance, which is said to be the second single tax in this country, is based upon a distribution of averages, and in that examination of facts, which is the foundation of science, the allotment of the various losses, both as to cause and amount, is the subject of systematic tabulation, whose results furnish the basis upon which insurance rates are levied, for the old method of competition guessing is a matter of the past.

The causes which contribute to the origin of fires are largely those of chemical reaction, while the resistances to fire are dependent upon construction and fire apparatus. Thus the modern method of fire loss prevention is a technical proposition, requiring the service of chemists and engineers. The national board of fire underwriters maintains a testing laboratory which contains the necessary facilities for making the investigations required in this study of matters pertaining to the fire hazard.

It is here that the supplies and subsidiary devices of commercial electricity are put to their proper test, and the results have great weight in furnishing additional features to the national electrical code. Their quarterly reports containing lists of fires caused by electricity, and stating the deviations from the code which are supposed to have been the origin, are compendiums of exact information on the subject.

The associated mutual insurance companies of New England were pioneers in the application of technical work to the reduction of the fire loss, a task whose beneficent results have extended beyond the mills which form the specialty of this combination.

The underwriters assume a great task in undertaking to maintain inspections over properties as widely extended and as numerous in detail as that of the commercial applications of electricity. The results show beyond peradventure that the electrical fire hazard is less than that of lighting and power transmission, while every telephone, being a fire alarm, the signaling systems are potent elements in the reduction of the fire loss.

While the diminution of the ratios of such fire losses appears to be due to this work, as the veritable element in the problem, the question naturally arises, will the future permit its continuation to an extent which will be equal to the greater task of meeting the problems of depreciation of plant and the congestion of the future to which the present applicatio of electricity are a mere preface.

If the work remains in hands which can exercise the responsibilities to a uniform jurisdiction, then it will be sustained by the dominance of an approving public sentiment.

Advertising Show in Madison Square Garden, New York City.

The first annual advertising show will be held at Madison Square Garden, New York city, from May 3 to May 9. The show will be under the management of George F. Parker and J. B. Bieder, of 116 Nassau street, New York city, who managed a similar show at the Coliseum, Chicago, Ill., last fall. It is the aim of the promoters of the advertising show to place before the public advertising specialties of all kinds.

SEISMOGRAPH RECORD OF THE SAN FRANCISCO EARTHQUAKE.

BY WALDON FAWCETT.

Through the aid of electrical science the United States government was enabled to secure a very satisfactory permanent record of the recent earthquake disturbances which assumed their most violent form on the Pacific coast. The chronicle in question is the more interesting from the fact that it was obtained through the vibrations of a sensitive needle located at Washington, D. C., thousands of miles from the scene of greatest activity.

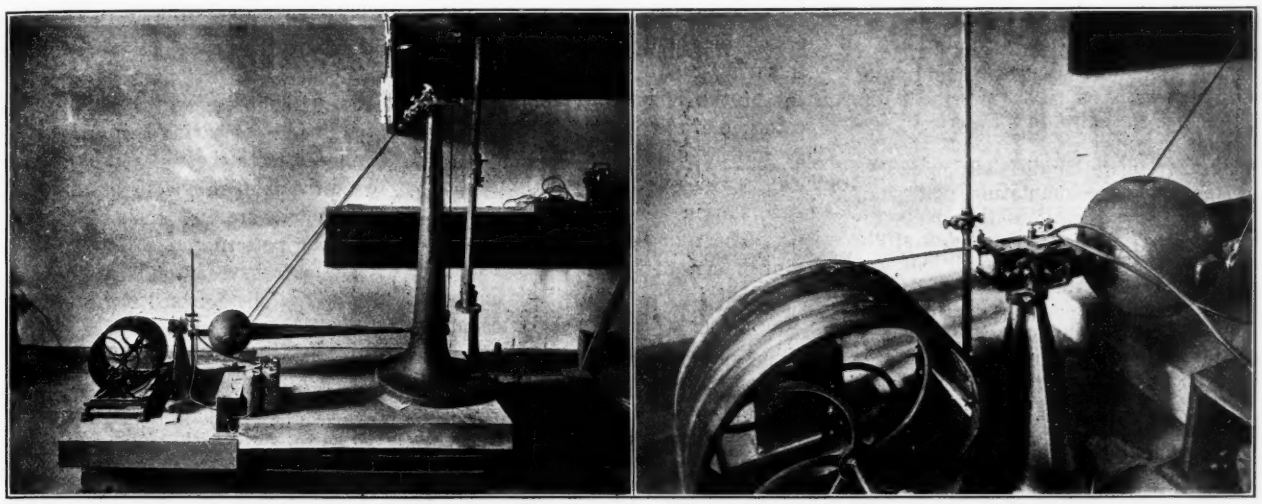
The apparatus employed by the government scientists is an instrument known as the seismograph, the function of which is to record all earthquake shocks, violent or slight. It is located at the headquarters of the United States Weather Bureau. For some years past it has been the policy of the United States Weather Bureau to require its observers to take careful note of earthquake phenomena of sufficient intensity to be felt at weather stations, but it is only at the central office of the Weather Bureau in Washington that there has been provided apparatus for automatically recording and measuring the trembling of the earth.

A seismograph was first installed in the year 1892 but the original instrument was one of very simple form. More recently, however, the equipment has been improved by the installation of one of the large horizontal pendulums made by J. & A. Bosch, of Strassburg, and designed after the models devised by Omori. The new instrument is of a very superior type and gives an accurate record of the movement of the earth at the pendulum in the horizontal plane.

The mechanical principles involved in the construction of a seismograph of this type were first developed and applied by James A. Ewing, at the time professor of mechanical engineering at the University of Tokio, but now professor of mechanism and applied mechanics at the University of Cambridge, England. Numerous modifications have since been incorporated in the instrument by Gray, Omori and others, and in its present form it is well adapted to measure and record all kinds of earthquakes and is especially suited to register the feeble, unfelt earthquakes which frequently occur in all parts of the world.

The delicate instrument is installed in a small basement room at the Weather Bureau and the separate castings are secured to thick blocks of stone, cemented firmly into the concrete floor of the build-

ing and projecting but a few inches above the floor level. The largest component part of the instrument is a heavy casting which supports the so-called horizontal pendulum. Next in importance is a massive lead weight rigidly attached to a conical tubular rod the end of which terminates in a hardened steel plug, hollowed out cup-wise and highly polished. At this point the pendulum is supported upon a sharp conical-pointed stud of hardened steel fixed to the casting. The remaining support for the pendulum consists of a pair of steel wires.

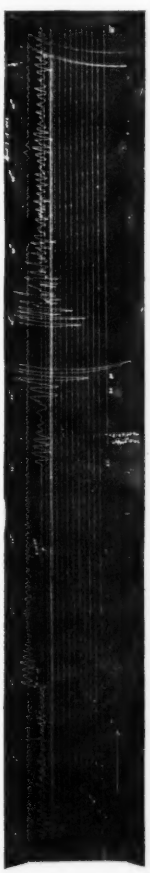


THE SEISMOGRAPH IN THE WEATHER BUREAU OBSERVATORY AT WASHINGTON, D. C., FOR REGISTERING EARTH TREMORS.

At the weight end these are attached to eyes with a knife-formed inside edge and these engage two studs that project laterally from the lead weight. The wires are united to a stirrup which is provided with a bit of hardened steel and is supported on a sharp hardened steel cone attached to a carrier forming the summit of the large casting first mentioned. This carrier is provided with several adjusting screws.

The pendulum is supported on sharp steel points and swings with great freedom of motion. When the pendulum is in neutral equilibrium the lead mass will remain at rest in any position, but for practical work a small degree of stability must be imparted to the weight lest minute changes of temperature and other influences which it is impossible to control cause it to wander about from one position of rest to another. The whole object sought in this construction is to secure a "steady mass," as it is called, that is a mass that shall remain quite at rest during an earthquake, notwithstanding that the earth and the supports of the mass are undergoing appreciable vibratory displacements.

The recording of the movement of the earth during an earthquake disturbance is accomplished primarily by means of a magnifying and recording lever made of very thin sheet aluminum bent into an inverted trough-shaped section to secure stiffness. The record is traced on a sheet of smoked paper wrapped around a large cylinder. In order that the friction may be reduced as far as practicable at the tracing point the coating of soot is made relatively thin and paper with a highly-glazed surface is employed. The record cylinder is driven at the rate of one revolution per hour and the axis at one end is cut with a steel screw thread which shifts the cylinder endwise as it revolves. The stylus therefore traces a helical line on the drum, thus separating the successive portions of the record.



A SEISMOGRAPH RECORD, TAKEN AT WASHINGTON, D. C., OF THE SAN FRANCISCO, CAL., EARTHQUAKE.

An important feature of the apparatus is an electric time marker the magnet of which is in connection with a circuit closer actuated by a high-grade clock. The circuit is closed momentarily once each minute and causes a finger to mark a time stroke each minute on the trace. When an earthquake occurs all the parts of the instrument partake of the motion of the earth except the lead weight. A contributory lever also remains at rest and hence the stylus traces on the drum a magnified record of the movement of the ground supporting the instrument.

The recent disturbance was the first earthquake on the Pacific coast the record of which has been recorded on the seismograph at Washington. It was almost 8.20 o'clock on the morning of April 18 that the instrument at the central office of the Weather Bureau began to record the San Francisco disturbance. The stronger wave motion began at 8.25 o'clock or about five minutes after the first perceptible tremors and the recording pen was carried entirely off the record sheet by the violence of the motion from 8.32 to 8.35 o'clock. After the latter time the motion gradually diminished but did not cease until long after noon. The vibratory motion of the ground at Washington was really a comparatively slow and deliberate motion, each back and forth movement taking fifteen or twenty seconds' time. The greatest movement of the ground registered before the pen went off the sheet amounted to about four-tenths of an inch.

Flux Distribution in Machines with Commutating Poles.

An investigation suggested by Professor E. Arnold, of the Technischer Hochschule, at Karlsruhe, having for its object to determine the effect on the main flux of a dynamo or motor caused by commutating poles, has been made by Messrs. T. F. Wall and S. P. Smith, says the *Electrician* (London), April 6. It was desired first to investigate the distribution of flux due to a single commutating pole, and, secondly, to both commutating poles together when the main poles were fully excited. The theoretical conditions are considered briefly; first, consider only one commutating pole, and supposing the main poles to remain unexcited, the flux due to the commutating pole will pass symmetrically into the two main poles, provided, of course, a symmetrical arrangement of poles be secured. Supposing the commutating pole to be unexcited and the two main poles excited, the entire main flux would pass from one main pole to the other, none entering the commutating pole. A similar condition would obtain if both commutating poles were excited and the main poles unexcited. If both commutating and main poles be excited simultaneously, the resulting flux will be obtained by superposing the two individual effects, and each flux would practically be independent and unaffected by the other. The experimental investigation consisted in exploring different parts of the magnetic circuit by means of search coils and a ballistic galvanometer. The two-pole type of field was used, giving, with the auxiliary poles, four poles altogether. Exploring coils were placed around the main poles, around the commutating poles, around the base of one commutating pole, a coil placed encircling the armature so as to lie parallel to the main flux, and two coils placed on the armature so as to include practically all the commutating flux which entered the armature. The results of experiments are shown graphically. As was to be expected, some leakage takes place from the flanks of the commutating pole to the yoke, due to the fact that the commutating pole was working at a high saturation. The flux from one excited commutating pole is shown to have distributed itself uniformly between the two main poles, and it was found that there is some disturbance of the flux in the yoke due to the fact that but one commutating pole is excited, so that the portion of the main flux passing around through the other side of the yoke is somewhat increased. There is also some disturbance of the main flux passing through the armature under these conditions. With both commutating poles excited, the experimental results indicate that the two fields are independent of each other, each being the same as it would be if the other were absent. The flux entering the armature from one commutating pole is equal to that passing out to the other, and is also equal to the flux passing through the large coil placed around the armature.

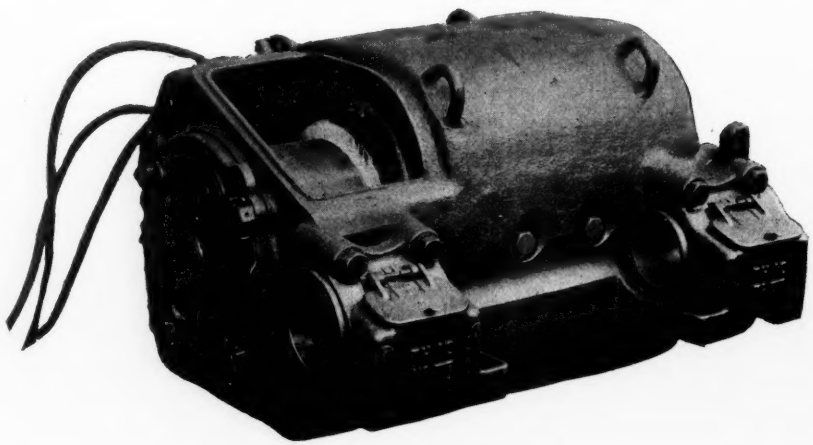
NEW OUTFIT FOR PARIS SUBWAY.

C. L. DURAND.

In a recent article[1] there was described some of the new material which has been supplied for running the Paris subway, this having been made necessary on account of the increase of traffic and the opening up of the new sections of the line. The former description related to the machines which were installed in the Bercy central station and the different substations. The following is a brief description of the new motor outfit for the trains, seeing that in the future it is intended to use a double-bogie truck instead of a simple two-wheeled truck, as the former has proved to be much better. A considerable number of the double-bogie trucks have been already supplied for the subway, especially since the No. 3 section running from the avenue de Villiers to the place Gambetta was opened. Up to the present ninety car outfits have been furnished by the Compagnie Française Thomson-Houston. The trucks, one of the bogies of which is illustrated herewith, and also one of the new motors, have given good satisfaction since they commenced running in the subway, and it has been decided that in the future all the new cars will be thus equipped. As to the exterior form of the car body it does not present any great changes over the type which is already known.

The trains which are running at present on the No. 3 section are made up in general of three motor cars and two trailers, which represent a total weight of 130 to 140 tons when fully loaded with passengers. Some time ago the Metropolitan company introduced the new type of car which was designed to be an improvement over the cars employed on the road since the latter was opened. While the general form of the car remains about the same, being of the usual square form with doors opening on the sides and the motorman's cabin in the front end, the design of the truck has been entirely changed. The first car had simply two axles without bogies, while in the new type two bogies having two axles each are employed, with the two motors placed between the axles on one of the bogies. The new motors are, as usual, of the single-reduction pattern.

The cars have a total length of fifty-two feet. The forward bogie which carries the motors lies just under the motorman's cabin and the motors can be easily inspected by means of a trap in the flooring. The two motors have a capacity of 175 horse-power each, and are of the four-pole enclosed type. As they have been entirely designed and built in the Paris shops of the company, it may be of interest to give a short description of them. Using a tension of 500 to 600 volts, such as is supplied by the third rail, the three motor cars of the train, comprising six motors of the above type, will give at starting on a level grade a mean acceleration of twenty inches per second and allow of obtaining a nominal running speed of twelve or thirteen miles an hour, with stops of fifteen seconds at the stations, which are spaced from 1,300 to 2,000 feet apart on this section of the line.



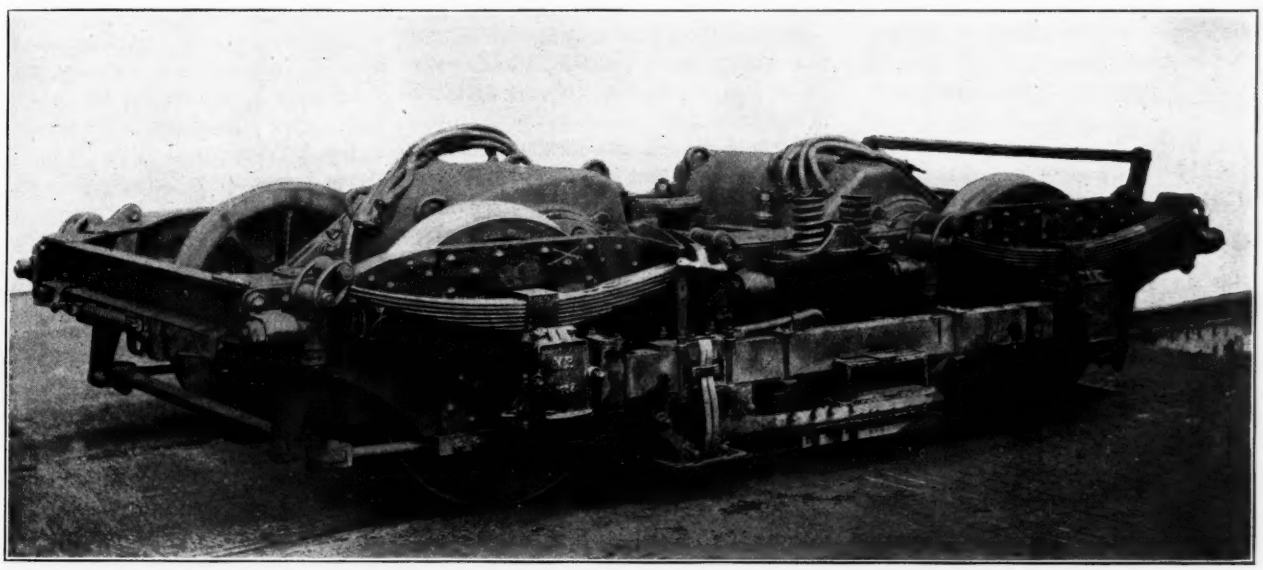
ONE OF THE MOTORS, NEW PARIS-METROPOLITAN SUBWAY EQUIPMENT.

One of the illustrations shows the appearance of the new motor, which takes a normal current of 240 amperes at 600 volts when giving 175 horse-power. After an hour's run under these conditions none of the parts of the motor are found to have risen more than seventy degrees above the atmosphere, the latter being assumed to lie below twenty-five degrees. Including the gear system the efficiency of

[1] February 3, 1906.

the motor varies from 0.86 to 0.88, according to the load, within the usual limits. Before it is allowed to run on the road the motor is given a good insulation test at the factory, and while heated up it has 3,000 volts alternating current applied between the windings and the iron.

The motor has been designed for the standard gauge track of 1.44 metres (fifty-eight inches). Its total length, including the gear case, is fifty-two inches. When in the position of rest the lower part of the motor clears the rail level by forty-five inches, the diameter of the car wheels being thirty-four inches. The motor rests upon the axle on one side by two bearings provided with bronze friction collars, and on the other side it is suspended by two heavy lugs, each of which is held between two opposed coiled springs, one of which rests upon the cross-beam of the bogie.



Truck, Showing Mounting of the Two Motors, New Equipment for the Paris-Metropolitan Subway.

These springs are guided and fixed by rods and bolts. As will be observed, the outer casting is formed of a single steel piece and it has an unusually high magnetic permeability. The pole-pieces, four in number, are built separate and fixed to the casting. These pole-pieces are formed of laminated iron of 0.06 inch gauge, and the field coils are held on the poles by means of special springs. The top of the case has the usual opening for inspecting the commutator, etc., and this is done from the inside of the car. In practice this motor is found to be very tight, and no trouble has been experienced from dust. As regards moisture it is evident that in the subway this is a secondary matter, as the latter is quite dry.

The field coils of the present type are constructed of copper strip windings. The dimensions of the strip are 1 x 0.04 inch, and a flat coil is formed which is insulated with mica and asbestos. This is found to give a very solid coil and one which will stand all the vibration of the road. As to the armature it is of the usual slotted drum type and is built up of 0.06 inch laminated iron. The armature has an exterior diameter of twenty inches and an interior diameter of nine inches. Its total length, including the insulation, is fourteen inches. Good means of air circulation within the armature are provided by a number of air holes. The winding in this case is made up of copper strip having 0.68 x 0.064 inch section and comprises 231 armature sections placed in thirty-three slots. The commutator is formed of 231 hard-drawn copper strips insulated with mica, and it is sixteen inches in diameter with a working length of eight inches. The shaft of the motor has a mean diameter of four inches and has the bearings calculated so as to avoid overheating. The armature is provided with oil deflectors, which are designed to prevent any oil from penetrating into the motor. Three carbon brushes are used upon the collector per brush-holder.

The bearings of the armature are fixed separately upon the motor casting and a simple arrangement is adopted to allow of removing the armature when placing the motor shaft either in the vertical or the horizontal position. To increase the surface of the bearings they are extended on each side with the interior of the armature. The bearings are of bronze lined with babbitt metal, and the oiling is carried out by a thick oil or grease which is brought in contact with the shaft by means of wool.

The gearing is of cast steel and forged steel, and the speed reduction is from sixty-two to twenty-seven teeth, or a ratio of 2.29 : 1. The gears are contained in the usual grease box. The weight of the present motor without the gearing is 5,950 pounds, or 6,600 pounds with the gears and case.

The Production of Alcohol from Carbide.

A short note in *Nature* (London), March 29, calls attention to a new carbide which has been prepared at St. Alban, France. The peculiarity of this carbide is that when it is acted upon by water it sets free ethylene. As is well known, calcium carbide gives acetylene and aluminum carbide gives methane. The ethylene obtained from the carbide is pumped into sulphuric acid, by which it is absorbed, with the production of ethyl hydrogen sulphate. When ethylene hydrogen sulphate is acted upon by water alcohol and sulphuric acid are produced. By distillation the alcohol can be set free from the sulphuric acid and the acid can again be obtained in concentrated condition by evaporation. Further, the metallic oxide which is used in the production of the carbide is again obtained when the carbide is acted upon by water, so that the production of alcohol is summed up in the equation: carbide plus energy equals alcohol. At the present time the quantity of carbon which should theoretically be required is only one-quarter of that used in the experiments. The quantity of energy required is not stated.

THE EARTHQUAKE AT SAN FRANCISCO.

ELECTRICAL INTERESTS SUFFER SERIOUS DAMAGE.

The earthquake and conflagration which wrecked and devastated the major portion of the business and residence sections of San Francisco, Cal., last week have occasioned a very extensive loss to the electrical interests of that city. Outside of the public service corporations, which naturally suffered very heavily, all of the supply stores and offices of agents and representatives of electrical houses throughout the country experienced heavy losses. The larger number of the electrical supply houses are located on Mission street, in the downtown section, one or two buildings containing the offices of a great many representatives of the eastern manufacturers.

The street car system of the United Railways suffered very extensively, the converter stations being damaged and the conduits in many places becoming impassable.

The Pacific States Telephone Company lost all of its exchanges in San Francisco, and has probably suffered a money loss of between $3,000,000 and $4,000,000. A new exchange building, costing, with its equipment, at least half a million dollars, and which was nearly ready for use, was entirely destroyed.

A carload of telephone material was shipped by express from Chicago by the Western Electric Company last Saturday, and other supplies, including emergency switchboards, cables and telephones, have been going forward regularly by fast freight since that day. One fortunate feature for the electrical interests is that the large building belonging to the Western Electric Company, with all its supplies, was but slightly damaged by the earthquake and fire, and all the stock was saved. These supplies will be a great help to the electrical operating companies looking toward rapid reconstruction. H. B. Thayer and A. L. Salt, vice-president and assistant manager, respectively, of the Western Electric Company, New York city, were in San Francisco the week preceding the earthquake. They are congratulating themselves that they got away just in time to escape the horror and dangers of the situation.

The buildings of both the Western Union Telegraph Company and the Postal Telegraph-Cable Company were destroyed by fire, and all their supplies and instruments lost. The Western Union company estimates its loss at about half a million dollars, as it had considerable supplies in stock. The Postal loss was small, comparatively. New offices have been opened by both companies, the wire situation is being straightened out, and a fairly large volume of business is being handled, the companies making extensive use of automatic systems, which is expediting the sending and receiving of messages.

Assistant General Manager J. C. Barclay, of the Western Union Telegraph Company, and Vice-President E. C. Bradley, of the Postal, were in personal charge of the telegraph situation at New York. Every encouragement was given to their operators to keep open lines of communication, and each company issued bulletins of information to the press and public during the progress of the conflagration.

The Post street plant of the San Francisco Gas and Electric Company is reported to be but slightly injured. A fortunate feature of the electric light and power distribution in the city lies in the fact that the major portion of the current comes from the hydraulic stations located in the hills.

Early in the present week the announcement was made that street cars were running on Fillmore street, and that there was apparently plenty of power. Manager Mullaly, of the United Railways, was hopeful that cars would be running on Turk and Eddy streets, establishing communication from the ferry building, or terminal, to different portions of the city. It was also expected that by the middle of the present week a temporary service would cover the greater part of the city. Transportation for all passengers and supplies is to be free until conditions are relieved. Mayor Schmitz has granted a temporary franchise for a trolley system down Market street, to remain in force until revoked.

The Bryant street electric power station is in full operation. The North Beach power station is slightly damaged. The two cable power-houses operating the Hayes and McAllister street lines were not burned. Only seven out of a total equipment of 455 electric cars and seventy-five out of a total equipment of 423 cable cars were burned. Some shops and stores on hand were burned and damaged.

The total general loss to all the physical property of the railroad company is estimated by George H. Davis, engineer-in-charge, at $2,000,000. A large part of this property, everything indeed except damage to track and overhead structure, is covered by insurance against loss by fire.

Operation of the Fillmore and Sixteenth street line was resumed on Saturday night. This line extends from North Beach south along Fillmore street, across Market street to Sixteenth street, and thence east along Sixteenth street to Kentucky street, at a point near the Union Iron Works. Kentucky street parallels San Francisco bay and is the nearest through street to the bay. The approximate length of the Fillmore and Sixteenth street line is five miles and forms a belt beyond and around the part of the city which has been burned.

The warehouses of the John A. Roebling's Sons Company, at 25 and 27 Fremont street, and 26 and 28 Beale street, San Francisco, were destroyed. Through the courtesy of the Pacific Steel and Wire Company the Roebling company was able to establish temporary quarters at Oakland. Large quantities of bare and insulated wire, originally intended for San Francisco, have been diverted to Oakland, and additional shipments are being made to this point, so that customers who have been dealing with the company at San Francisco may be supplied from the stock at Oakland. The stocks in the warehouses at Los Angeles, Portland and Seattle will also be increased.

The General Electric Company suffered very materially. The only definite information received by the officers of the company has come in the shape of a telegram from Dr. Addison, the manager of the Pacific coast territory, stating that, as far as he knew, all the members of the San Francisco organization were safe. The company has carried regularly in San Francisco a stock of material valued at several hundred thousand dollars. The warehouse was located in the burned district. The indications are that the stock was entirely destroyed and that the offices of the company in the Crossley Building were wiped out. The company has established an office in the Union Savings Bank Building, Oakland. M. F. Westover, secretary of the company, has proceeded to San Francisco and every effort will be made to put the business of the San Francisco office again on its feet at the earliest possible moment. It is understood that the company's property in San Francisco was amply covered by insurance.

The Crocker-Wheeler Company received a message from its representatives on the Pacific coast on Saturday morning of last week. This message was as follows: "Crocker-Wheeler Company, Ampere, N. J. San Francisco ruins. Martial law. Could not wire sooner. Our stock total loss. Generators reported good condition. Can see them Monday. No cars, water or light San Francisco. Express

immediately Wells-Fargo, Oakland, two hundred currency. Personal effects lost. Probably can leave upon receiving money. A. C. Bunker." The generators mentioned are three of the four 4,000-kilowatt, alternating-current Crocker-Wheeler generators recently sold to the California Gas and Electric Corporation for supplying current for the San Francisco street railway system. The plant in which these machines are installed is in a suburb of the city, about seven miles from the heart of the business section.

Two well-known members of the National Electric Light Association, John Martin, first vice-president of the California Gas and Electric Corporation, and Allan Pollok, general manager of the San Francisco Gas and Electric Company, were appointed by Mayor Schmitz members of the Committee of Safety.

In connection with the earthquake shock and the conflagration many tales of heroism have been told concerning the presence of mind and courage of the electrical operators under terrible difficulties. The disconnecting of the light and power circuits by the station operators at the time of the shock and the work of the telegraph operators fulfil the expectations of every one who has always regarded these servants of the public as part of a more or less military organization. In fact, the work of the telegraph operators has been heroic in the extreme, their messages telling, in disjointed fashion, the fearful story of the progress of the conflagration, indicating to those on the safe end of the line how the loyal fellows were being driven from point to point as the fire wiped out building after building.

Early in the progress of the fire Vice-President Bradley, of the Postal Telegraph company, when it was discovered that the wires between New York and San Francisco were destroyed, made an effort to reach San Francisco by telegraphing around the world. It was found, however, that the cable between Honolulu, Hawaiian Islands, and San Francisco would not work, and it was at first thought that there was a break within the vicinity of San Francisco bay. However, it was later determined that the cable force had cut and insulated the cable in the cable hut on the San Francisco shore of the Pacific ocean.

The Standard Underground Cable Company has established temporary offices in the Bacon Block, Oakland.

Within twelve hours of the disaster the General Electric Company had two carloads of miscellaneous supply material moving toward San Francisco. By the middle of the past week the company had some twenty carloads pushing forward to the Pacific coast; some direct to San Francisco, some to Los Angeles and Portland for redistribution. Practically all classes of electrical supplies likely to be needed in such an emergency were included in the shipments. More goods of all kinds will follow as rapidly as the conditions demand.

New York Electrical Club.

On Saturday, April 21, the Electrical Club, of New York, opened its doors with a reception in the afternoon. Nearly 100 gentlemen, all identified with the electrical interests, were present. The club has leased an entire floor at 14 and 16 Park place and the rooms have been comfortably and artistically fitted. In the suite of rooms is a general reception room, one devoted to billiards and an especially cheerful dining hall and a private dining room. The club starts with a membership of more than 150 names and it is believed that this membership will rapidly grow as a general meeting and luncheon place for the allied electrical interests should be appreciated. Reasonable prices are to obtain for the luncheon and dinner service. Among those present at the opening were the president of the Electrical Club, J. P. Hall, and the secretary, R. B. Corey; Major Robert Edwards, A. L. Deveau, V. C. Gilpin, J. E. Lockwood, A. S. Terry, Edward Rockefeller, B. C. Kenyon, E. B. Latham, John H. Dale, J. H. Hallberg, William Taylor, E. P. Eckert, C. E. Corregan, Alex Henderson, T. D. Watson, Geo. Pittman, W. B. Hall, Geo. L. Patterson, E. W. Bauschard, Chas. Auth, B. H. Ellis, John C. Dolph, C. I. Hills, E. S. Keefer, W. B. McCurdy, H. M. McCandless, C. C. Sibley, H. D. Jones, C. P. Scott, S. G. Meek, J. B. Olson, T. M. Debevoise, P. M. Fletcher, Henry L. Shippy, W. F. Weiss, R. M. Downs, E. Whitmore, Geo. F. Porter, C. J. Purdy, Wm. A. Rosenbaum, C. E. Van Cleaff, J. C. Hatzell, Harry Johnson.

The National Electric Light Association.

The executive committee of the National Electric Light Association held a meeting at New York city on Friday, April 20. Considerable routine business was discussed, and it was decided to move the offices of the association to the new Engineering Building when this was ready for occupancy. The report of the assistant secretary that the membership of the association would surely reach the 1,000 mark by the time of the convention was received with gratification. Consideration was given to a number of the details connected with the business and entertainment programme at the Atlantic City (N. J.) convention, June 5 to 8. Arrangements are being perfected for a most elaborate exhibit, the whole of Young's Pier being engaged for the week. The effort is being made to introduce a harmony of effect in decorative features by having all the booths conform to one general style of ornamentation.

The members of the committee present were: William H. Blood, Jr., Boston, Mass.; Arthur Williams, New York city; Dudley Farrand, Newark, N. J.; A. J. De Camp, Philadelphia, Pa.; Samuel Scovil, Cleveland, Ohio; Harry Bottomley, Fall River, Mass.; Louis A. Ferguson, Chicago, Ill.; Ernest H. Davis, Williamsport, Pa., and W. C. L. Eglin, Philadelphia, Pa.

Meeting of the Boston Section of the Illuminating Engineering Society.

A meeting of the Boston (Mass.) section of the Illuminating Engineering Society was held on Tuesday, April 24, at the American House, at 8 P. M. A paper entitled "Some Suggestions from the Gas Side," by N. W. Gifford, was read. The report of the committee on the constitution and by-laws was read and placed before the meeting for action.

The following officers were chosen for the ensuing year: chairman, John Campbell; secretary-treasurer, G. H. Stickney; executive committee, two years, C. L. Edgar, E. N. Wrightington; one year, Dr. Louis Bell, A. I. Sampson.

There were forty members present and seven new members were enrolled.

The Completion of the United States-China Cable.

On April 17 the president of the United States and the emperor of China exchanged messages of congratulation on the occasion of the opening of the Commercial Pacific Cable office at Shanghai, directly connecting the United States with Asia.

The laying of this cable completes the work commenced by the laying of the Commercial Pacific cable from San Francisco to Honolulu, and continued by the laying of cables between Manila and Honolulu by way of Guam and the Midway islands. Nearly 10,000 miles of submarine cable have been made and laid in an average depth of 2,640 fathoms. The president's despatch was the first to be transmitted over the new line, and the emperor's answer was the second.

COMMON ERRORS IN THE USE OF ELECTRIC MOTORS FOR MACHINE DRIVING.[1]

BY W. A. KER.

In all rotating engines the power in foot-pounds per minute is equal to the torque in pound-feet $\times 2\pi \times$ revs. per minute. In most machines, for driving which electric motors are used, the power required varies directly as the speed, the torque being constant, though in some machines (as, for instance, centrifugal pumps) the power increases in a much greater proportion. The torque of a motor might therefore be considered its most important property.

In what follows it is proposed to disregard the effect of armature reaction upon the total flux, as in modern motors this effect is extremely small. In a shunt-wound motor the flux is a constant quantity, the torque, therefore, varying directly as the armature current.

Fig. 1 shows the variations of the torque with the current for a sixty brake-horse-power, 500-volt, shunt-wound motor, recently installed in a Clyde shipbuilding yard, and running at 450 revolutions per minute at full load. The dotted line in the same diagram shows the torque of the same motor, having the same armature and brush gear, but having series-wound fields to give the same speed of 450 revolutions per minute at the same full load.

At full speed with full load, the torques of both the series and shunt-wound motors are the same, and the currents are the same, as the efficiencies of both machines are practically identical. It is evident from inspection that the torque of the shunt motor for small currents is much larger than the torque of the series machine. With a current of thirty amperes it is just double. This is opposed to the commonly held opinion that a series motor gives a much more powerful torque than a shunt motor, the usual argument being that, as in a series motor the torque varies as the square of the current, the torque must be larger. The users of this argument forget that one of the chief components of the torque is the magnetic flux, which is a constant quantity in a shunt motor, and a diminishing quantity with decreasing current in a series motor. Also the statement that, in a series motor the torque varies as the square of the current, is only true for one particular point of the saturation curve, and is not even approximately true at other points. In fact, the torque varies, as a rule, at much the same rate as the current itself for a considerable portion of the torque curve.

In speaking of the torque of a machine, the author refers to the external torque, available for performing work, not to the total torque, which has also to overcome the resistance of the armature to rotation, owing to friction of bearings, windage, eddy currents, etc., and with small armature currents, and the series-wound motor therefore running at a high speed, these losses are large. In Fig. 1 the curves show the external torque.

Fig. 1 also shows the torque curve of the same sixty-horse-power motor wound as a compound machine, having the series excitation at full load equal to about twenty per cent of the total excitation, and the series coils assisting the shunt.

A true compound motor has the series coils opposing the shunt coils, so as to obtain a practically constant speed (neglecting any variation of speed due to the alteration of temperature of the machine) at any load; but the applications of this type of winding are comparatively few, and the author does not propose to deal with them in this paper. An inspection of Fig. 1 shows that there is no valid reason for the adoption of a series-wound motor, in order to obtain a large torque, at all events up to the full load of the motor; and a shunt motor is more suitable for that purpose, even the compound motor being inferior to the shunt motor. Above full load, however, the series and compound motors have the advantage, but not to a great extent, until a large overload is reached.

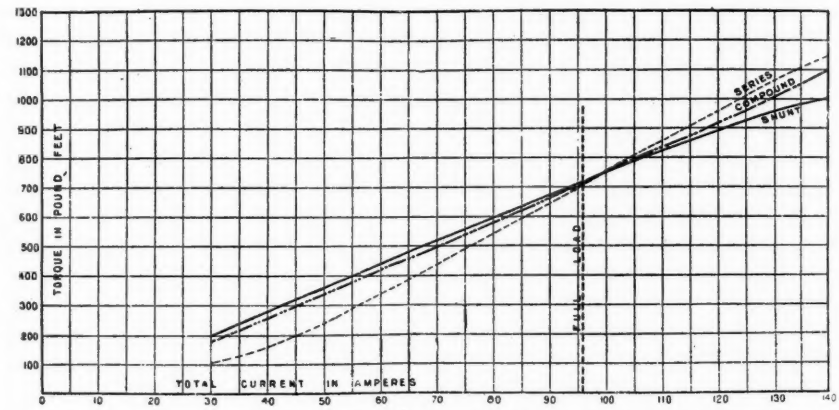


FIG. 1.—VARIATIONS OF TORQUE WITH CURRENT FOR MOTOR WITH THREE DIFFERENT FIELD WINDINGS.

Fig. 2 shows the speeds of the motor with the three types of winding. It will be observed that the shunt motor runs at an approximately constant speed with any load up to nearly fifty per cent overload, and that the compound motor varies to a moderate extent with the load. This effect can be greatly increased by increasing the proportion of series excitation to shunt excitation in the field winding, and it will be seen later the circumstances in which this should be done. The speed of the series motor varies greatly with different loads.

The conclusions to be drawn from Figs. 1 and 2 as to the type of winding to be adopted for any particular purpose are as follows: motor for practically constant speed and constant torque, though not necessarily full-load torque, shunt wound; motor for practically constant speed and varying torque, shunt wound; motor for approximately constant speed, varying torque, and subject to sudden overloads, compound wound; motor for varying speed and torque varying inversely as the speed, series wound. Motor for varying speed and constant torque should be shunt wound, with speed regulation effected by means of resistance switched, either automatically or by hand, into the shunt circuit. Motors of this type, having a speed variation of three to one, with practically no loss of efficiency, are commonly used; and the author has had machines with a speed variation of nine to one, without a sign of sparking.

The next point to be considered is regarding motors which are required to give a large torque for an extremely short time at frequent intervals, and which are fitted with flywheels, or have flywheels fitted upon the machines which they drive. The function which the flywheel is intended to perform is, of course, to give up a portion of its stored-up energy at the moment of demand for power, and so to relieve the motor of abnormal demands, and to equalize the drain upon the mains, in fact, to reduce the peaks of the current curve. A flywheel stores up energy by virtue of its mass and velocity, and it is evident that it can not part with any of

[1] Abstract of a paper read before the Institution of Engineers and Shipbuilders in Scotland, February 20.

that energy unless it is permitted by the motor to reduce its speed of rotation as the demand falls upon it.

A shunt-wound motor, when a sudden demand comes upon it, runs at almost the same speed as before, the only reduction in speed being that due to the lost volts caused by the resistance of the armature and brushes to the passage of the increased current through them. In Fig. 2 the shunt motor, with an increase of load of fifty per cent, runs some two per cent slower. This is a trifling reduction, and renders the flywheel of no practical effect, the motor having to supply nearly all the additional power suddenly called for. A shunt motor, therefore, is not suitable for this purpose.

Referring again to Fig. 2, it will be seen that the compound motor runs some eight per cent slower with an increase of load of fifty per cent. This is a sufficient reduction to permit the flywheel to do a reasonable amount of work, parting with

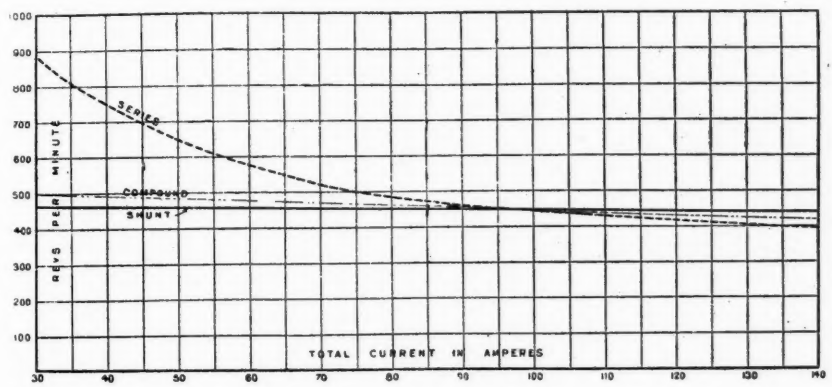


FIG. 2.—SPEEDS OF MOTOR WITH THREE DIFFERENT WINDINGS.

over fifteen per cent of its kinetic energy. To determine the correct proportions of the flywheel, in any particular case, is a matter of some difficulty, and only an approximation can generally be made. It is necessary to know the permissible reduction of speed at the end of the demand for load, the amount and duration of that demand, the period available for recuperation, and the permissible increase of load on the motor. It is evident that the motor and flywheel which are suitable for a heavy load, applied for a very short time at very frequent intervals, are not suitable for the same intensity of load for a longer period, with longer intervals. For example, let it be assumed that the sixty-horse-power compound motor is fitted with a flywheel, and is driving a machine which ordinarily takes forty horse-power to drive it, the speed of the motor being 475 revolutions per minute normally. Assume that the machine requires 147 horse-power for ten seconds, with one minute periods, that is, with ten seconds excess demand and sixty seconds recuperation. The excess demand is therefore 107 horse-power for ten seconds = 588,500 foot-pounds of work, and this is to be done partly by the motor, but chiefly by the flywheel.

Assume also that the overload of the motor is not to exceed fifty per cent of the normal full load of the motor, in this case equal to a current of 144 amperes. This is equivalent to a speed of motor of 420 revolutions per minute at the end of the demand period. The reduction of speed of motor and flywheel is therefore from 475 to 420 revolutions per minute, or 11.6 per cent.

The horse-power of the motor at the end of the demand period is about ninety, the excess therefore being fifty horse-power. This excess varies from nothing to the maximum of fifty horse-power, the average being twenty-five horse-power for ten seconds = 137,500 foot-pounds of work. The work to be done by the flywheel is therefore 588,500 — 137,500 = 451,000 foot-pounds.

To determine the proportions of the flywheel, first find the total energy it must store up. As its speed decreases by 11.6 per cent, it will part with 21.8 per cent of its kinetic energy. Its total energy at 475 revolutions per minute must therefore be $\frac{451{,}000 \times 100}{21.8}$ = 2,068,800 foot-pounds. A cast-steel flywheel, five feet six inches in diameter, with a face sixteen inches wide by twelve inches deep, would have this amount of energy, and as its peripheral speed is 137 feet per second, it would be quite safe. The work being done, the motor has to restore the 451,000 foot-pounds of energy to the flywheel in fifty seconds, this is an average of 16.4 horse-power.

The cycle of the motor therefore varies from forty horse-power at the commencement of the demand to ninety horse-power at the end, and then during the period of acceleration the power drops again until forty horse-power is again reached at the moment of the next demand; the average power of the motor being fifty-eight horse-power.

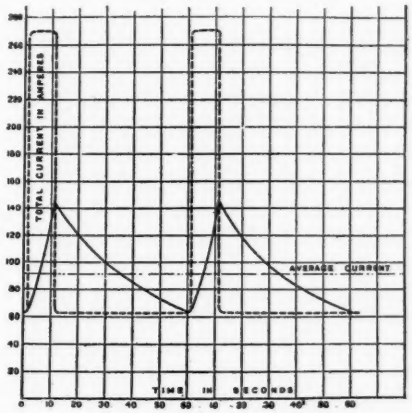


FIG. 3.—CURRENT TAKEN FOR WORK WITH AND WITHOUT FLYWHEEL.

Fig. 3 shows, by a full line, the current taken during two complete cycles; the dotted line showing the current that would be required if no flywheel were fitted. Though the total energy consumed is practically the same in both cases (the only difference being that due to the greater loss in the motor due to the larger current), a smaller motor can be used if a flywheel is fitted than is possible in the other case. There are two reasons for this: (1) the sparking difficulty; the limit of load in motors of this size is generally decided by the reactance voltage (especially in the case of high-voltage machines, such as this one), and the large current required at the peak of the curve, equal to three times the full-load current, would certainly cause the reactance voltage to reach an undesired figure; (2) the heating difficulty also would probably necessitate a larger machine; though the average current would be the same in each case, the heating effect is proportional to the mean square of the current (not to the square of the mean current), and would be much greater in the machine without a flywheel. Another advantage which Fig. 3 clearly indicates is that a much smaller generating plant is required when a flywheel is fitted on the motor, the maximum current being about half that in the other case.

Another example of the effect of a flywheel may be of interest, and for this purpose a punching and shearing machine has been taken. This machine is capable of punching holes one and one-half inches in diameter in plates one and one-half

inches thick, and of shearing the same plates. It is driven by means of a belt by a twenty-two-horse-power motor, and has two heavy flywheels fitted upon the machine. Fig. 4 shows the horse-power time curves, the motor being compound wound with twenty per cent compounding. It will be noted that one complete cycle when punching, and one complete cycle when shearing, are shown on the same diagram. The number of strokes per minute is thirty, making a two-second cycle. It is difficult to tell the exact length of time taken in punching a hole, and as far as the author is aware no experiments have been published. For the purpose of calculation, the time of punching the hole was taken at twenty-five per cent of the time taken by the punch to pass through the thickness of the plate, and the pressure on the punch was assumed to be 195 tons. The pressure while shearing was assumed to be 165 tons, and the time taken to be three-quarters of the time taken by the blade to travel a distance equal to the thickness of the plate. These figures are affected by the angle of the blade and the contour of the face of the punch; but they are believed to be fair average values.

It will be observed from Fig. 4 that the maximum power required while punching is much higher than the maximum power while shearing; but as the latter takes a longer time, the load on the motor is much more severe while shearing. In fact the motor is seriously overloaded. The flywheels are quite satisfactory while punching, but might, with advantage, be made heavier and larger in order to relieve the motor while shearing. This motor is of the variable-speed type, and can be made to run thirty-three per cent faster. If this were done the kinetic energy of the flywheels, assuming the motor at the end of the shear to reach the same terminal speed as at present, would be increased by 140 per cent.

Unfortunately, the practice is to run the motor at its slow speed when dealing with heavy plates, for two reasons: (1) owing to the difficulty in handling heavy plates, and (2) that, in shipyards at all events, the heavy plates are generally templet plates, and the holes must be accurately punched, a high speed not being desirable. When lighter plates are being handled the motor is speeded up and the kinetic energy of the flywheels increased, at the time when an increase is not necessary for power purposes. Fig. 4 shows clearly to what a large extent a correctly proportioned flywheel relieves the motor and generating plant. The author's intention in dealing at such length with the question of flywheels is to emphasize the advantage they possess in many cases, and the uselessness of fitting them on shunt motors.

The next type of motor to be considered is the reversing motor. A reversing motor is seldom required to make lengthy runs in one direction, but is nearly always desired to run for a few seconds, or perhaps minutes, and then stop and reverse, and in this rapid acceleration is a necessity. Acceleration is a function of the torque; therefore in this case also the shunt motor has an advantage over the series motor. It also has a disadvantage, *viz.*, that owing to self-induction the shunt coils take an appreciable time to build up the magnetic field, and the torque does not reach the amount shown in Fig. 1 until the field is fully excited. This is easily got over by keeping the shunt coils fully excited all the time the motor is required, and as the energy is only from one to (in small machines) five per cent of the total current the loss is trifling.

The constantly excited fields have the effect of bringing the armature to rest very quickly (when the armature current is switched off) owing to eddy currents in the core, and if a brake contact be fitted on the controller so that the armature can be short-circuited through a resistance, the armature will act as a brake, and also assist in bringing itself to rest promptly. This is a very important property for a reversing motor to possess. It appears, therefore, that a shunt motor, with fields permanently excited, is the best type to use for frequent reversing and rapid acceleration. It is true, however, that some machines, having moving parts with but a small inertia, and requiring often to work with a small load, when an increased speed of running with a fair acceleration are desirable (such as the hoisting gear of jib cranes with an empty hook) may, with advantage, be fitted with series motors.

The following list gives a few common machines and the types of motors which the author considers most suitable for them:

Boring mills: shunt wound, variable speed.

Radial drills: shunt wound, variable speed.

Countersink drills: shunt.

Large lathes: shunt, variable speed; or where brakes occur in the work generally dealt with, heavy cuts being taken for a portion of the revolution of the face-plate, and the rest of the revolution being idle, such as truing the ends of bob weights on a crank shaft, compound with flywheel.

Small lathes: shunt variable speed.

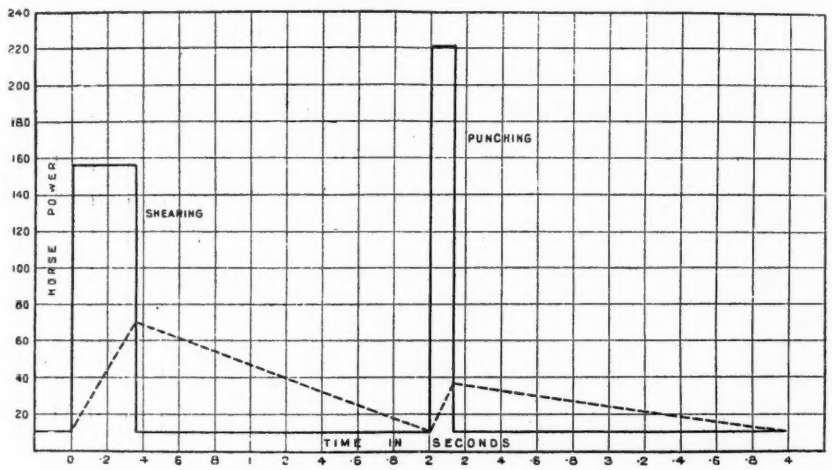


FIG. 4.—HORSE-POWER-TIME CURVES.

Planing machines: compound with flywheel. A resistance may be automatically switched into the shunt circuit to increase the speed on return stroke with advantage.

Milling machines; shunt.

Shaping machines: shunt.

Slotting machines: compound with flywheel.

Cold saws: shunt.

Punching and shearing machines: compound with flywheel.

Plate bending rolls: these are reversed frequently, and have great inertia and considerable friction, even if fitted with ball bearings. The driving motor should be compound, and may, with advantage, be fitted with a flywheel to add to the kinetic energy of the moving rolls, and relieve the motor by supplying the extra power required at the first nip of the plate, and it should be fitted with a magnetic or foot brake to stop the rolls quickly. The mag-

netic brake may be connected in series with the motor, as the initial current is large. The roll shifting motor should also be compound to get a large torque at starting. A series motor is not satisfactory, as the speed of the roll gets somewhat high and it is difficult to stop it at the exact position required. A powerful magnetic brake should be fitted for this purpose.

Mortar mills: compound with flywheel.

Circular saws: compound, with small flywheel, to assist motor when the saw meets knots in the wood.

Band saw: shunt.

Frame saw: shunt.

Wood planer: shunt.

Mortising and tenoning machine: shunt.

Cargo winch: compound. These are often made series wound; but so much of the time of a hoist is occupied in easing the load out of the hold that the greater torque of the compound motor, with a small current, overbalances the quicker speed of the series motor with light loads.

Shipyard winch: compound. The distance at which the work is performed is often considerable, and great skill and care are required on the part of the winchman if a series motor is used, especially with light loads.

Skull breaking winch: this is usually fitted with a series motor, and as the load is constant, and the inertia of the tup, at starting to hoist, constitutes an overload, the series motor has the advantage.

Three-motor traveling crane: in shops where rough work is carried out and great nicety of handling is not required, a series motor is the best for hoisting, as with light loads the speed increases and enables the work to be performed more quickly.

In iron foundries, especially where delicate ornamental work is done, delicacy of handling is the most important point, it often being necessary to raise or lower a box a quarter of an inch at a time. In this case a compound motor has all the advantage. The small current required for a given small torque means that the craneman has to move his controller on to its first or second notch to move the load, in place of on to the fourth or fifth notch, as would be the case with a series-wound motor, and he can therefore stop it more quickly. The motor should have its shunt coils permanently excited, and be fitted with a shunt brake, so that whatever the current in the armature the brake may pull off quickly. A series brake does not pull off until a considerable current is passing through the armature, though once it is off a small current suffices to hold it off.

In engine-erecting shops a compound motor should be used for the same reasons. With a series motor a good deal of time is lost by the craneman raising or lowering the work too far. The traveling and cross-transverse motors may be series wound, as the inertia, even with an empty hook, is great, and the minimum load is considerable. A brake may be fitted with advantage. If, however, great delicacy of movement is required, these motors should also be compound wound, for the same reasons as have been advanced in the case of the hoisting motor.

Most electric hoists and lifts have balance weights fitted equal to the combined weight of the cage and half the ordinary load to be lifted. This enables a small motor to be used, and ensures economy in current consumed. It is evident that, with half load in the cage, the motor will have no work to do, save to overcome the friction, and if a series motor be used, it will run at a very high speed, and there will be considerable difficulty in stopping the cage at the right place. A compound motor is the most suitable, though shunt motors are often used. They should be fitted with shunt brakes, and the armature itself may be used as an additional brake with advantage.

The torque required at starting centrifugal pumps is very small. Until the critical speed is reached no water is delivered, and any small increase of speed above that point means a large increase in the water delivered, and therefore of the power absorbed. A shunt motor should be used, having a variable resistance in the shunt circuit, so that the exact speed to give the required delivery of water may be obtained.

Assuming the suction and delivery pipes to be charged, the torque of the reciprocating pumps is constant at any speed, with the exception that when running the friction of the water in the pipes comes into play, and the torque varies accordingly. A shunt-wound motor is quite suitable, and may have speed regulation to vary the delivery. A series motor may also be used, having speed regulation, by shunting a portion of the current from the field coils to increase the speed, or by resistance in the armature circuit to reduce the speed. A series motor has one advantage for this purpose; but fortunately it does not often occur. If one of the suction valves gets hung up, preventing one of the pump barrels from working, the load on the motor is reduced, and it runs faster, the other two barrels (assuming it to be a three-throw pump) deliver more water, and the increased speed and noise draw the attention of the driver to the fault.

For pumps operated at a distance a series motor is probably best. Only two cables are required, the starting switch being fixed in the engine room, and an ammeter in the circuit enables the driver to know, by any variation in the current, if attention is required at the pump. The author was connected with the installation of a pump of this nature some ten years ago which is still working successfully, the current being transmitted some two miles and the pump being visited about twice a week.

For cupola work Root's blower motors should be shunt motors with speed regulation by shunt resistance, so that the pressure and quantity of air delivered may be varied as the charge settles.

For forges shunt motors should be used.

It may be well to point out that the question of time of acceleration from rest and energy expended is a somewhat complex one, and that a great deal depends upon the method of controlling the current during the acceleration period. It is obvious that if a motor is accelerating a machine which requires the full load of the motor to drive it at full speed, and if it be possible to so regulate the current by the starting switch that the current at once equals the full-load current and never exceeds it by more than a small fraction, it does not matter whether the motor be shunt, compound or series wound it will accelerate the machine in the same time with the same expenditure of energy. This, unfortunately, is an impossible condition, as supply companies do not allow the full-load current to be drawn suddenly from the mains; but they insist upon gradual increases in steps of ten or twenty amperes, and in private installations, for the sake of generating plant and other motors and lights, it is not advisable to do so. It is therefore necessary to accelerate by gradual increments of current, and it is in the earlier stages that the shunt and compound motors have the advantage.

In all the preceding it has been assumed that the motor and the machine are direct-connected, or at all events that there is no appreciable slip between the motor and the machine. There is one very interesting machine, however, which starts from rest, and, as made by one of the best-known firms in Glasgow, has purposely a very large slip. The reference is to centrifugal machines, either sugar centrifugal or hydro-extractors. In this particular type the motor drives the basket through a centrifugal friction clutch. The motor, in machines of the latest type, is

series wound, and is thrown on to the mains direct by a double-pole switch, no starting resistance being employed.

The high self-induction of the series field coils prevents the sudden rush of current being excessive. In most cases which have come under the author's notice, the initial current is not appreciably greater than that taken by the motor ten seconds later. The motor in a few seconds attains the speed corresponding to the current, the slippers of the friction clutch fly out by centrifugal force and the basket begins to revolve. The basket accelerates rapidly until it attains the same speed as the motor, when the motor and the basket accelerate together until full speed is obtained. The friction of the slippers represents a loss of energy of fifty per cent of the motor output, until the motor and basket are running at the same speed, after which no such loss occurs. The aver-

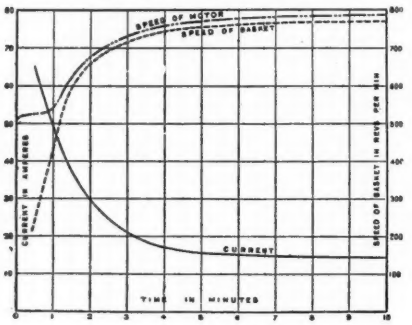


FIG. 5.—CURRENT AND SPEED CURVES.

age power taken during the acceleration period is often six or seven times the power taken when running at full speed, and the power at the start is often more than double the average power. A very specially designed motor is therefore necessary. The actual power depends upon the time of acceleration, and this varies with the class of sugar to be worked.

The interesting point in this machine is that if a shunt or compound motor be used there is a much greater loss of energy, as, owing to their much higher speed with a given current, the speed of the basket does not equal the speed of the motor until a much later period, and the energy lost, caused by the friction of the slippers, is much greater. There is also the advantage that some sort of starting resistance must be used with these motors.

On the other hand, the series motor has the disadvantage that, though the total energy required is less, the initial demand is greater; but as usually a number of these machines are used in one installation, and they do not all start at the same time, the generating plant may be practically the same as would be necessary with shunt or compound motors. Fig. 5 shows the current curve and speed curves for a basket and series motor of one of these machines. It will be noted that the basket speed never quite reaches that of the motor. This is probably due to vibration, causing a slip in the friction clutch, and there must be some slight loss in this; but it is also the case when shunt or compound motors are used.

It may be asked why the motor should not be direct coupled to the basket. The objection to this is, that the motor would have to contend with the inertia of the basket when starting, as well as its own inertia, and a very large starting current, necessitating a starting resistance, would be required. By introducing the friction slippers, the motor has only its own inertia and the friction of the slippers to overcome in starting.

New York City Traffic.

The New York State Board of Railroad Commissioners has made public a compilation of statistics of the number of passengers carried and transferred on the street surface, elevated and subway railroad lines of New York city during 1905, as compared with 1904. The number of paid fares was 1,171,151,698, an increase of 93,439,451. The number transferred was 271,195,524, an increase of 7,816,362. The car mileage was 290,249,455, an increase of 28,664,543.

Comparative statistics by boroughs are:

PAID FARES.

	1904.	1905.
Manhattan	689,638,134	745,896,116
Brooklyn	338,961,835	372,584,004
Bronx	24,650,755	25,002,165
Queens	16,800,353	19,493,173
Richmond	7,607,170	8,176,240

TRANSFERS.

Manhattan	173,751,290	166,125,312
Brooklyn	69,547,584	85,225,229
Bronx	16,257,584	15,356,061
Queens	3,023,120	3,695,954
Richmond	793,622	792,968

CAR MILEAGE.

Manhattan	126,186,232	149,334,212
Brooklyn	61,942,825	67,943,149
Bronx	7,492,269	6,403,478
Queens	3,900,025	4,244,982
Richmond	2,263,561	2,323,634

Gift of the International Electrical Congress to the American Institute of Electrical Engineers.

At the last meeting of the board of directors of the American Institute of Electrical Engineers the gift of the International Electrical Congress of a fund for the library was formally accepted. This gift disposes of the balance which was left in the treasurer's hands after all expenses connected with the St. Louis congress had been paid. Resolutions have been adopted by the directors of the Institute to the effect that the fund shall be known as the "International Electrical Congress of St. Louis (1904) Library Fund," and that the annual income shall be expended in the purchase of foreign or non-American electrical literature for the Institute library. The fund, which now amounts to $2,067.06, has been deposited in a trust company.

Professor Pierre Curie Killed.

Professor Pierre Curie, who, with his wife, Mme. Marie Curie, discovered radium, and did such important work in radioactivity, was killed in Paris on the afternoon of April 19, being run over by a wagon in the Place Dauphin.

Professor Curie was born in Paris, May 15, 1859. He was the son of a physician, and early showed a scientific bent. He was educated at Sorbonne, and at the age of twenty began experimental investigations in chemistry. In this work he was assisted by Marie Sklodowska, a Polish lady, herself devoted to physics and chemistry. Professor Curie was made professor of physics at the School of Physics and Chemistry, Paris, in 1895, and at about the same time married Mlle. Sklodowska. Although without any outside means, Professor and Mme. Curie devoted themselves to scientific work, giving to this as much of their income as they could spare. They started first a study of the magnetic properties of steel, but were later led to an investigation of the conductivity of the air under the rays given out by uranium and thorium. This work led them to the investigation of pitchblende, and later to the discovery of radium. Since then other important discoveries have been made, notably that of polonium, and the fact that radioactive materials continuously give off heat. The properties and peculiarities of these new elements have been thoroughly studied and many important scientific facts brought to light. A good deal of work was also done in cheapening the cost of producing compounds of radium and its allied elements. Their work was recognized by many scientific bodies. In 1901, two years after the discovery of radium, the French Academy of Sciences awarded to them the La Caze prize of 10,000 francs. In December, 1903, the Nobel prize for chemistry was awarded to them, and a little later they received 60,000 francs, being part of the French Osiris prize, in recognition of their scientific work. In 1904 Professor Curie refused the decoration of the Legion of Honor, as he said that he did not think the hope of receiving decorations of that kind was necessary as an inducement to acts of devotion or courage. Professor Curie leaves, besides Mme. Curie, one daughter nine years old.

BOOK REVIEWS.

"Projektierung Elektrischer Licht und Kraftübertragungsanlagen." Peter Stierstorfer. Potsdam. A. Stein. Cloth. 289 pages. 6½ by 9½ inches. 216 figures and 14 tables. Price, 9 marks.

This treatise on the design of electric light and power stations takes up the matter in some detail. All apparatus used in such plants is described, the characteristics of the different machines explained, the mathematical laws for laying out conductors are given and the author then passes to the larger problem of design of the plant.

"Standard Telephone Wiring." James F. Fairman. New York. McGraw Publishing Company. Flexible leather. 91 pages. 4½ by 7 inches. Illustrated. Supplied by the ELECTRICAL REVIEW at $1.

This little handbook has been prepared as a guide to the telephone. It describes clearly, using diagrams, the underlying principles of telephony, the apparatus employed and the various systems in use, such as the common battery, the magneto systems, intercommunicating systems and extensions. The book contains also the rules of the National Board of Fire Underwriters governing the installation of signaling systems.

"Cours de Physique de l'Ecole Polytechnique." Third supplement. M. Bouty. Paris. Gauthier-Villars, Imprimeur-Libraire. Paper. 420 pages. 5½ by 9 inches. 104 figures. Price, 8 francs.

This volume forms the third supplement to the course in physics prepared by M. J. Jamin. It has become necessary in order to bring the subject up to date, and deals with the important and highly interesting investigations into radiations and the passage of electricity through gases which have been made during the past six years. In fact, the subtitle of the volume is "Radiations; Electricity; Ionization." The treatment is descriptive rather than analytical, frequent use being made of curves, although, where necessary, the calculus is employed.

"Electricity Meters." Henry G. Solomon. Philadelphia. J. B. Lippincott Company. Cloth. 324 pages. 6½ by 9 inches. 307 illustrations. Supplied by the ELECTRICAL REVIEW at $5.

This is a fairly complete treatise on electricity measuring instruments taken up from an English viewpoint. The author discusses first the laws governing the operation of such machines, and then passes to detailed descriptions of a large number of meters of all kinds. American, English and other foreign makes are fully discussed, both direct, single-phase and polyphase types being taken up. The book also takes up briefly methods of charging for electric power and the use of prepayment meters. A special chapter deals with the peculiar mechanical features of certain meters. Instructions are also given for testing meters, both in the shop and after they have been installed.

"The Wiring Handbook." Cecil P. Poole. New York. McGraw Publishing Company. Flexible leather. 85 pages. 4½ by 8 inches. 32 tables. Supplied by the ELECTRICAL REVIEW at $1.

This is a useful little wiring book. It discusses the essential principles of wiring, both for lighting and power purposes. Clear diagrams are given showing how the auxiliary apparatus, which is often left to the wiremen to install, should be connected up. Diagrams are employed for computing the power required under different conditions, and an appendix gives a digest of the underwriters' rules applying to inside wiring. The book covers the field very satisfactorily and as it is not at all padded, it is conveniently small.

"Management of Accumulators." Ninth edition. Sir David Salomons, Bart. New York. D. Van Nostrand Company. Cloth, 178 pages. 5 by 7 inches. Illustrated. Supplied by the ELECTRICAL REVIEW at $2.50.

This book has been prepared by rewriting vol. i of the author's work on "Electric Light Stations and the Management of Accumulators." It aims to give practical instruction for the care and maintenance of storage batteries when employed as auxiliaries in lighting systems. The general treatment of the subject is well known. The present edition has been brought fairly well up to date by eliminating much descriptive matter that has been superseded, putting in place of it discussions of later improved forms of batteries. Besides this discussion of the different types of cells the author goes to some detail as to the proper methods of setting up batteries, charging, discharging and the faults and remedies incident to the use of batteries.

"A Treatise on Producer-Gas and Gas-Producers." Samuel S. Wyer. New York. Engineering and Mining Journal. Cloth. 296 pages. 6¼ by 9½ inches. Illustrated. Supplied by the ELECTRICAL REVIEW at $4.

This is a fairly complete treatise on the subject of gaseous fuels, a subject which has been attracting more and more attention of late years. The author first gives the fundamental physical laws and definitions which must be understood clearly in a study of this kind. Chapter ii deals with underlying chemical principles in the same way. Chapter iii takes up thermal and physical calculations. The different kinds of commercial gas are first discussed and then the subject proper of the book—producer gas—is taken up. The progress which has been made in this matter is shown. Different types of producers are classified and discussed, the virtues of each being brought out. Fuels, their character and use, are discussed; methods of making tests; computating the efficiency of a producer; the care and operation of producers, and all phases of the work involved in the use of this apparatus. The book concludes with a bibliography on the subject. It will be a welcome treatise to those who are particularly interested in the use of producer gas.

"Practical Electric Railway Handbook." Second edition. Albert B. Herrick. New York. McGraw Publishing Company. Flexible leather. 460 pages. 4½ by 6¾ inches. Illustrated. Supplied by the ELECTRICAL REVIEW at $3.

The second edition of this handbook has been brought up to date by rewriting a number of the sections and inserting descriptions of more recent systems and appliances. The book gives a very brief discussion of electrical units and laws, and then takes up the various parts of a railway system. A large number of tests for locating faults in the car equipment or in outdoor plant are given. Methods of track laying, bridge construction, types of power-houses, boilers and engines and electrical apparatus are all fairly well considered, with possibly a few exceptions. Some of the minor appliances seem to have been overlooked. For example, there is nowhere a discussion of the collecting devices—a small, though a very essential, part of every electric car equipment.

"Electric Railway Accounting." W. B. Brockway. New York. McGraw Publishing Company. Cloth. 84 pages. Diagrams. Supplied by the ELECTRICAL REVIEW at $1.25.

This is a very useful little book and should prove acceptable to the managements of the many electric railway systems distributed throughout the country. As is well known, the financial standing of many small roads is apt to be in doubt, an opinion which prevails pretty widely being that many of these roads were built for speculative purposes. The proper system of accounting and reporting, if adopted, would soon show the actual standing of all these roads. Mr. Brockway gives here some useful suggestions and shows report forms which have been found of value. He also discusses the relation of operating expenses to earnings and some other units of comparison, and goes somewhat into details as to the use of curves as a means of expressing the varying conditions of the system from day to day. He discusses the value of statistical information, shows how useful standardization of accounts may be, and emphasizes the value of frequent expert examination of the accounting department.

The Separation of the Losses in Induction Motors.

The power taken by an induction motor when running light is the sum of the various losses occurring in the motor, and the separation of the total loss into its several components is of much importance to the designer. A method of doing this has been described by Mr. G. W. O. Howe. Various methods have been proposed before, but they have been open to the objection that they assume the slip of the motor to be directly proportional to the load, which is not true. The present method is due to Bradstad, and is an adaptation of the well-known method of finding the losses in one motor by driving it from another which has been accurately calibrated. The latter machine is a direct-current machine separately excited, and is coupled directly to the induction motor under test. Four sets of readings are taken: first, of the power taken by the direct-current motor running light; second, of the power taken by the direct-current motor when coupled to the induction motor, both stator and rotor windings being open-circuited; third, of the power taken by the direct-current motor when the stator is connected to the polyphase supply, the rotor running open; fourth, of the alternating power supplied to the stator in the latter case. These readings should be obtained for various speeds below and above synchronism, and the results plotted in four curves. The most striking feature of these curves is the sudden break in the curves showing the power taken by the direct-current motor with the stator of the induction motor connected to the alternating-current supply and the curves showing the alternating power absorbed, when passing through synchronous speed. This break is due to the torque exerted on the rotor by the rotating field. When the rotor is below synchronism this torque tends to drive it on, and when it is running above synchronism the torque is reversed. It is due to the hysteretic effect in the rotor and is a torque which tends to keep it running in synchronous speed. If the friction be made small enough, or the rotor hysteresis large enough, it will run in synchronous speed. If the friction increase beyond a certain limit the rotor will begin to slip. The hysteresis torque, however, remains the same, and the power given from the stator to the rotor remains constant, being equal to the product of the torque and the angular velocity of the field. The speed of the rotor has decreased and with it the power given to it mechanically by the torque. The difference —that is to say, the product of the torque into the angular velocity of slip—appears now as heat in the rotor iron; hence, just below synchronism a certain part of the frictionless losses is supplied by the stator and is read on the alternating-current wattmeter, in addition to the stator iron loss, with the result that the direct-current motor is relieved of some of the frictional load. For this reason the assumption that slip is proportional to load, including friction, is not true, for the motor can be loaded up to a certain point before slipping begins. If the motor be rotated above synchronism, the direction of the torque is obviously reversed, and work is done on the stator by the direct-current motor. Both the slip and torque change signs, and their product therefore remains unchanged. This sudden decrease in the alternating-current power supplied to the stator on passing through synchronism must be equal to the sudden increase in the load on the direct-current motor; and, further, both of these are double the hysteresis loss in the rotor at rest. The stator iron loss is the mean of the two readings of the alternating-current supplied to the stator at synchronism. The friction loss is given directly as the difference between the curves showing the power taken by the direct-current motor running light and the power taken by it when driving the induction motor light. The mean difference at synchronous speed between the curves showing the power taken when driving the induction motor light and the power taken by the direct-current motor with the stator excited is the generally neglected loss in the teeth of the stator and the rotor due to the rapidly pulsating flux. As the loss is caused by the rotation of the rotor, the power necessary to cover it must be supplied by the rotor and will be included in the load on the direct-current motor without affecting the reading of the stator loss on the alternating-current wattmeter. In the case of an ordinary induction motor running light this loss in the teeth will have exactly the same effect as an increase in the friction and energy. The following results were obtained from a twenty-horsepower induction motor: friction loss, 100 watts; stator iron loss, 250 watts; loss in teeth, 230 watts. The sum of the three gives 580 watts, while with the motor running light in the ordinary way the wattmeter shows 575 watts. The sudden break in the two curves, which, as explained, is due to hysteresis in the stationary rotor, amounts to 100 watts, indicating a hysteresis loss of fifty watts. —*Electrician* (*London*), *March* 30.

A Test of Large Alternators.

Two large alternators constructed for the Johannesburg municipality, South Africa, by Siemens Brothers & Company, of London, England, were given a public test recently. These machines are to be directly-driven by gas engines. They are rated at 1,800-kilovolt-amperes, at 3,300 volts, two-phase, fifty cycles, and operate at a speed of 100 revolutions per minute. They are intended to work on a circuit having a power-factor of 0.75. At this power-factor the output will be 1,350 kilowatts, corresponding to 275 amperes per phase. It was required that these machines should run for twelve hours at full non-inductive load of 1,350 kilowatts without the temperature rising more than fifty degrees Fahrenheit above the air at any part. The excitation at full load and a power-factor of 0.75 was not to be more than twenty kilowatts. The machines were tested by a modification of the Hopkinson method. They were coupled together on a temporary shaft mounted on an ordinary bed-plate. The rotor of one machine was given a displacement of about twenty-five electrical degrees with respect to the other. The leading machine was then run as a generator under normal working conditions. The other machine operated as a motor with a slightly reduced flux. The necessary power to overcome the losses was supplied by a continuous-current motor directly-coupled to the shaft.

The preliminary tests showed that the losses for one alternator at an output of 1,377 kilowatts, non-inductive, were eighty-three kilowatts, not including bearing friction. The losses were made up of the following: energy, nineteen kilowatts; iron losses, thirty-eight kilowatts; copper loss in the stator, ten kilowatts; in the field, sixteen kilowatts. The total efficiency at full load was therefore 94.3, including excitation.

National Interstate Telephone Association.

A map has been commenced for the state of New York, making the fifteenth state for which independent toll line maps are being prepared. These maps will be displayed at the Chicago convention, showing all lines for which data have been received. These data should reach the general headquarters, Cleveland, Ohio, not later than May 25.

The annual convention will be held at the Auditorium Hotel, Chicago, Ill., June 26, 27 and 28. The various committees will meet at that place June 25. The convention programme is now being prepared.

PROGRAMME FOR THE ANNUAL CONVENTION OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

MILWAUKEE, WIS., MAY 28 TO JUNE 1.

The annual convention of the American Institute of Electrical Engineers will be held at Milwaukee, Wis., May 28 to June 1. The date is set thus early to enable members to attend the convention and to take part in the European trips the latter part of June.

The Institute headquarters will be at the Hotel Pfister, Milwaukee.

The following programme has been announced:

MONDAY, MAY 28.

1. Address of welcome.

2. Address—President Schuyler Skaats Wheeler.

3. "Repulsion Induction Motor," by Maurice Milch, associate, General Electric Company, Schenectady, N. Y.

4. "Direct-Current Motor Design as Influenced by the Interpole," by Charles H. Bedell, associate, Electro Dynamic Company, Bayonne, N. J.

TUESDAY, MAY 29.

5. "Experiences with Lightning and Static Strains on 33,000-Volt Transmission Systems," by Farley Osgood, associate, New Milford Power Company, New Milford, Ct.

6. "Cell-Type Lightning Arrester," by E. E. F. Creighton, associate, Union University, Schenectady, N. Y.

7. "Protective Apparatus for Lightning and Static Strains," by H. C. Wirt, associate, General Electric Company, Schenectady, N. Y.

8. "Short-Circuit and Ground Currents in Alternating-Current Systems," by Chas. P. Steinmetz, member, General Electric Company, Schenectady, N. Y.

WEDNESDAY, MAY 30.

9. "Magnetic Properties of Electrolytic Iron," by Chas. F. Burgess, member, University of Wisconsin, Madison, Wis., and A. Hoyt Taylor, University of Wisconsin, Madison, Wis.

10. "Measurement of Temperature by Electrical Means," by Edwin F. Northrup, associate, Leeds & Northrup Company, Philadelphia, Pa.

11. "The Educational Value of an Electric Test Car," by T. F. Morgan, University of Illinois, Urbana, Ill.

12. "The Art of Inventing," by Edwin J. Prindle, associate, New York.

13. "Shunt and Compound-Wound Converters," by W. L. Waters, member, National Electric Company, Milwaukee, Wis.

THURSDAY, MAY 31.

14. (Title to be announced later), by David B. Rushmore, member, General Electric Company, Schenectady, N. Y.

15. "Economics Derivable from the Use of Relatively Small Water Powers of Low Head in the Middle West," by Dugald C. Jackson, member, University of Wisconsin, Madison, Wis.

16. "Oscillations and Surges against Ground in Alternating-Current Systems," by Chas. P. Steinmetz, member, General Electric Company, Schenectady, N. Y.

17. "Relative Merits of Various Types of Booster Control," by Joseph Bijur, associate, General Storage Battery Company, New York, and Lamar Lyndon, associate, New York.

18. "Safety Devices for Steam Engines, Turbines and Motors," by Charles M. Heminway, associate, Consolidated Engine Stop Company, New York.

Applications have been made to the principal passenger associations for reduced railroad rates for members and guests who attend this convention. The Western Passenger Association, the Trunk Line Passenger Association and the Central Passenger Association will probably grant the rate of one and one-third fare for the round trip on the certificate plan, which allows the holders of such certificates to purchase tickets for the return trip at one-third the regular fare, provided there are at least 100 certificates presented.

Further details regarding transportation arrangements will be given later.

Some Notes on Gas Engines for Electric Lighting.

A few notes have been given by Mr. R. C. Dieppe which are intended to assist the electrical engineer in the selection of a gas engine for an isolated lighting plant. When asking for quotations for a gas engine it is advisable to state the following particulars regarding the engine which the bidders are to furnish: the maximum brake-horse-power of the engine for one hour; the continuous working brake-horse-power of the engine; the speed of the engine in revolutions per minute; piston speed, maximum variation in volts in, say, fifteen minutes when running on half, three-quarter and full load, the load in each case being kept practically constant during the fifteen minutes; the maximum variation in volts when the load is suddenly changed from one-half load to full load, or the other way; the maximum emission pressure upon explosion when running on maximum load and on the continuous working load, and the consumption of gas at one-half, three-quarter and full load. When comparing various engines the ratio of the maximum brake-horse-power to the continuous working brake-horse-power should be noted, as it is desirable to have this as high as possible. It is important to remember that the maximum horse-power of a gas engine is a definite thing and can not be exceeded. A gas engine which gives twenty-five-horse-power continuously should give thirty brake-horse-power as a maximum for one hour. Regarding the speed of the engine the speed of the piston is the chief point to watch, and this, for a twenty-five-horse-power engine should not exceed 750 to 800 feet per minute. Anything above the latter figure should be questioned. In checking the voltage variation for the fifteen-minute run, under constant load, it is generally sufficient to read the maximum and minimum volts on the voltmeter. The maker should not question this requirement, since under the conditions of operation the voltage will be directly proportional to the speed. If the initial pressure in the engine is too high there will be an objectionable bump in the engine when running at full load. This noise should not be confused with the noise made by the exhaust. The consumption of gas is, of course, important, and a guarantee should be made covering this point. It is also advisable, if the engine is to go inside the building, to have a representative of the maker inspect the site where it is to be placed. The engine company should also be asked to design the foundations for the engine, so that there will be no question of responsibility if excessive vibration occurs. While the preliminary test of the engine may be made at the maker's shops, the real test should be made after installation. The maker of the engine should be told the name of the dynamo maker and should also be asked to agree upon an electrical load to be used for testing. This very much simplifies the carrying out of the test.—*Electrical Review (London), March 30.*

National Electric Light Association Membership.

It is expected that the membership of the National Electric Light Association will have reached a full thousand at the time of the Atlantic City, N. J., convention, June 5 to 8. Only a comparatively few names are needed to make up this number, and at the rate applications are now coming in there is no doubt of the full 1,000 being listed.

Electricity in Newspaper Offices.

At a meeting of the American Newspaper Publishers' Association recently, Mr. John Norris, business manager of the New York *Times*, read a paper entitled "Electricity in Newspaper Offices." The following data are of great interest, showing as they do the last analysis of current consumption for one of the largest New York dailies. The figures are presented in such form that they may be readily assimilated and a very good idea secured as to the advantage of using electricity for a motive power and in other departments of such a complex organization.

At its former location at 41 Park row the New York *Times* paid for 195,000 kilowatt-hours per annum for newspaper uses only. At its present location, with an expansion in output and with an expansion of more than 100 per cent in space occupied, the total consumption for newspaper purposes is substantially the same—that is, 200,000 kilowatt-hours.

The electricity used in operating our presses at 41 Park row was fourteen per cent greater than at Times square, though our output in printing at Times square was much larger. The difference is due to efficient and economical motors and controllers.

Our total consumption of electricity for presses in 1905 was 53,252 kilowatt-hours. At 41 Park row for the same service in 1904 our consumption was 60,955 kilowatt-hours.

In printing the newspaper the New York *Times* averages 571 watts per 1,000 eight-page sheets, which at an estimated price of three and one-half cents per kilowatt-hour would cost less than two cents per 1,000 eight-page sheets. In view of the fact that we print over nine million eight-page sheets per month, we pay more for a pressman to operate one press than that which we pay for all of the power necessary to print our entire edition.

The current for stereotyping has averaged six and one-half kilowatt-hours per 100 plates produced by autoplate, or one-fifth of a cent per plate, or fifty-six cents per night. We use an average of thirty-seven gallons of water to cool each plate at a cost of one-half a cent for water.

The gas for baking matrices and for heating the throats of autoplates costs nine-tenths of a cent per plate. The coal used in heating our stereo metal costs three-quarters of a cent per plate. The heating of linotype metal costs one-half a cent per 1,000 ems.

Our linotypes have used forty kilowatt-hours per night, or $1.39 per night, or one-seventh of a cent per 1,000 ems of machine composition. Summarizing this cost, we find an interesting comparison of the cost of electricity with other items in newspaper manufacture:

Composition—Cost of power per 1,000 linotype ems, one-seventh of a cent; cost of gas for melting linotype metal per 1,000 ems, one-half of a cent.

Stereotyping—Cost of power per plate, one-fifth of a cent; cost of water for cooling per plate, one-half of a cent; cost of gas for baking matrices and heating throat of autoplate per plate, nine-tenths of a cent; cost of coal for heating metal, three-quarters of a cent.

Presswork—Cost of power per 1,000 eight-page sheets, two cents.

The Times Building elevators traveled 3,001 miles in the month of January. That work is watched closely. A daily record of the number of feet traveled by each elevator is made up by counters attached to the elevator drums. The daily use of electrical energy is also measured. From this data the average number of kilowatt-hours, per car-mile each day, is ascertained to determine if the motors and controlling apparatus are in condition. The figures for January show that elevators traveling 3,001 miles required 11,522 kilowatt-hours, an average of 3.84 kilowatt-hours per car-mile. No. 1 elevator, which has the highest rise in the world, 326 feet, traveled an average of forty-two miles for each day of the month of January, about three times the usual building average.

The Kohler controllers for operating the autoplates electrically have been entirely satisfactory. Through the operation of the controllers we have made an accurate chart of every movement of a press during the night, and have obtained a basis for an automatic story that will give truthful testimony of press performances to the publishers, paper maker and press builder. We have a record of every break of web, every change of roll, every change of plate, and the speed of the press at all times.

Our light installation for newspaper and building is equal to 2,956 sixteen-candle-power lamps—1,534 lamps for newspaper and 1,422 for building. Our renewals for the year were 1,600 sixteen-candle-power lamps and 2,400 eight-candle-power lamps. Our Nernst lamps gave us a brilliant light. We will use them in the new drug store.

Forty-four Cooper Hewitt lamps are installed in the Times Building, the Cooper Hewitt Company guaranteeing a life of 100 days of ten hours each. Our cost for mercury vapor lamp renewals has been trifling. There has been a total of thirty-seven renewals, of which we have paid for fifteen. The service has been satisfactory.

The use of central station service and the avoidance of an isolated plant has enabled us to maintain during the summer and winter an absolutely uniform temperature of eighty-five degrees in our pressroom, which is fifty feet underground. We did not use any steam for six months of the year, except that which was generated at midnight in the two-quart retorts in the moulding room on the sixteenth floor to bake matrices. Uniformity of temperature should be helpful to delicate machinery. We heat our building with low-pressure steam. On the coldest days not more than four pounds pressure is required, and our building, with one possible exception, is the tallest office building in the world—that is, above the curb. It is concededly the highest from base to top. Where most of the skyscrapers of New York have temperatures in summer in their basements almost unendurable and destructive alike to health and property, our lowest basement does not vary four degrees from the standard we maintain. During the hottest days of last July the temperature in our pressroom at noon was appreciably lower than on the street above. Imagine what this means in the pressroom, where everything is more or less affected by temperature changes as well as by high temperatures.

We had hoped that the maintenance of uniform temperature would avoid any occasion for change of rollers, but we failed to take into account the matter of humidity. Some printing plants have tried a "humidifier." Possibly, next summer, as a result of the use of the drug store's refrigerating apparatus, we may be able to work out a plan which shall obviate the necessity for changing rollers with the seasons.

Our electric paper hoists have never caused us the slightest bother. The electric kitchen has been installed though not initiated. We tried to bake paste by electricity and found the apparatus costly. We put hair curlers in the ladies' toilet, and satisfied ourselves that the principal user was a scrub woman.

The consumption of electricity in the Times Building is less than forty per cent of that estimated by the engineers in planning for our new building.

By adopting central station service and avoiding the use of the isolated plant, we saved $80,000 on cost of installation. The

cost of operation for 1905 was $19,000 less than the engineers' estimate of what outside service and heating would cost. We saved $14,000 as compared with the engineers' estimate of what the operation of an isolated plant would cost. We saved at least 800 feet of space in the basement. We saved the operating expense of keeping the basement cool in summer. We saved the use of coal, or steam, for six months of the year. We avoided the nuisance of taking in coal and taking out ashes, and we saved the cost of breakdown connections.

Wireless Telegraphy in Naval Warfare.[1]

The great importance of the work done by the Japanese scouts need hardly be commented upon. The only question that has ever arisen has been as to the means, and a new implement has sprung into the arena. "The battle of the Japan sea was won by the wireless telegraph," is the reported exclamation of one enthusiast. And there is no denying that it did marvelous work. It was by means of it that the Japanese commander learned of the approach of the enemy and understood, while still miles away, his exact strength, position, formation, course and speed, and could make his initial moves before sighting him or being sighted by him. It is worthy of note that the first intelligence of the enemy was flashed, not by an armored cruiser or even by a protected cruiser, but by a large merchant ship scout, the Shinano Maru. Torpedo craft had been used as picket boats off Port Arthur, being fitted with wireless and being thus also ready to oppose any night sortie; but a sound appreciation of the difference in conditions was shown in now keeping them for their legitimate work and not assigning them to duty as high-sea scouts. Apart from wearing out the crews, to attempt to combine the two types would indeed result in a hybrid of minimized value. Destroyers may possibly come to be larger than at present, for their own purposes; but information service is *sui generis*, with an importance all its own. Speed, and size to maintain it in a seaway, are the prime requisites, supplemented by powerful wireless apparatus and enough battery to prevent being driven off by torpedo craft.

Whether or not the wireless was employed as a means of signaling to the fleet during the action is not known at the present writing; it is most improbable. But we read farther in Admiral Togo's report of how Admiral Nebogatoff's squadron was intercepted and surrounded: "At 5.20 A. M. . . . I received a report from our cruiser squadron which was about sixty miles behind steaming to the north, that several columns of smoke were seen in the east. Soon after, the same squadron approached the enemy and reported again that the enemy consisted of four battleships (afterward it was found that two of them were coast-defense ships) and two cruisers and were then heading northeast. It was certain that those ships were the principal remnant of the Russian fleet. Upon this the battleship and armored cruiser squadrons reversed their course and gradually steamed toward the east so as to appear at the head of the enemy . . . and at 10.30 A. M. we completely surrounded this enemy. . . ." Greater tributes to the success and value of this invention would be difficult to conceive. It now remains to accomplish selectivity, with all that the term implies.

[1] Excerpt from an article entitled "Gleanings from the Sea of Japan" by Captain Seaton Schroeder, U. S. N. in the *Proceedings* of the United States Naval Institute, March.

The Annual Report of the New Orleans Railway and Light Company.

The New Orleans Railway and Light Company was organized under the laws of Louisiana, June 12, 1905, with a capital stock of $30,000,000. The company has a bonded indebtedness of $30,000,000 of general four and one-half per cent gold mortgage bonds. Of this there is held in escrow an amount equivalent to the outstanding bonds of the underlying companies, amounting to $12,806,000. On July 16, 1905, the company acquired by purchase at receiver's sale the properties owned, leased and controlled by the New Orleans Railways Company. The fiscal year covers the period from January 1 to December 31. The company therefore had a corporate existence of five months and sixteen days, and the New Orleans Railways Company a period of six months and fifteen days. The operations of the acquired companies of the New Orleans Railway and Light Company cover a period of six months, from July 1 to December 31, and are given for comparative purposes as follows: gross earnings, $5,093,709.79; operating expenses, $2,671,460.35; fixed charges and taxes, $1,784,226.24; leaving a surplus for that period of $638,023.20. During the past three years there has been expended on the property for betterments and improvements the sum of $3,653,302.05.

The companies included in the operations are the New Orleans & Carrollton Railroad, Light and Power Company, St. Charles Street Railroad Company, Orleans Railroad Company, New Orleans & Ponchartrain Railroad Company, New Orleans Lighting Company.

An Electric Safety Lamp.

A type of incandescent lamp designed to give as nearly absolute security against fires or explosions as possible has been devised by Dr. D. Tomassi, of Paris. The idea is to extinguish the lamp automatically should the protecting globe be broken and to prevent the flying of incandescent particles if the lamp globe itself should be shattered.

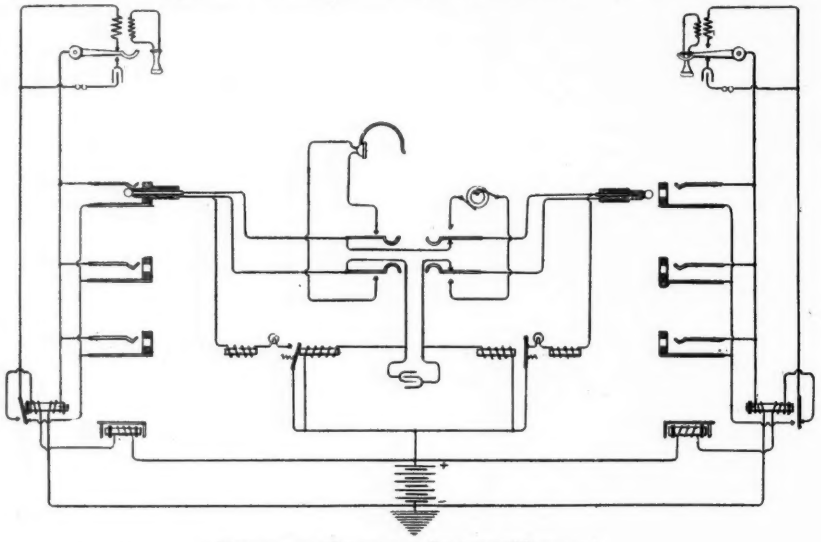
The method of doing this consists in surrounding the globe of the lamp itself by a second glass covering fitted so as to be air-tight. Within this second globe is a switch which normally stands open, but which, when subjected to air pressure, closes the circuit and allows the lamp to light. The lamp is lighted by forcing air into the outer globe, in this way closing the switch. If, then, the outer globe be shattered, the reduction in air pressure which takes place immediately will extinguish the lamp before the inner globe is broken. If, on the other hand, the inner globe breaks, the reduction in pressure of the air in the outer globe due to the collapse of the inner globe will open the switch and put the lamp out. In case of an accident of this kind the outer globe will, of course, stop all flying particles and prevent any fire. It is thought that the lamp will have value in mines exposed to explosive gases, in powder magazines and in other places where there is danger of an explosion.

Control of Telephones in Canada.

Another step has been taken in the matter of the control of the great public corporations of Canada. Hon. H. R. Emmerson, minister of railways, introduced a bill in the house, the feature of which is the placing of telephone rates under control of the railway commission. Mr. Fitzpatrick, minister of justice, announced the government's intention of making this control as effective as that now exercised over railway freight and passenger rates by the same tribunal, a control which has not elsewhere been equaled in the world where private ownership prevails. The bill also provides for the interchange of traffic between telephone companies, and removes a barrier to the entrance of independent telephones to railway stations by removing from consideration in settling the compensation any exclusive contract between the railway and any other telephone company. The speeches of Mr. Emmerson and Mr. Fitzpatrick were received with every mark of attention, and the leader of the opposition gave assurance that he would do all he could to assist in perfecting the measure.

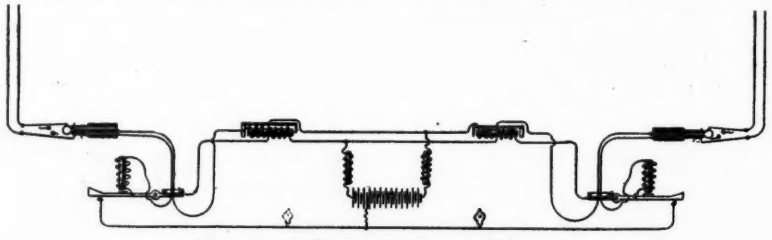
Electrical Patents.

Harry G. Webster, Chicago, Ill., has obtained a patent (816,052, March 27) for an improved telephone exchange system, and he has assigned it to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. The invention relates to telephone exchange systems, and more particularly to the supervisory signaling system employed in connection with the means for interconnecting subscribers' lines, this supervisory signaling system serving to notify the central station operator of the operative condition of connected lines. The invention is particularly applicable to multiple switchboard exchange systems in which operator's cord connecting apparatus is employed for the purpose of connecting two telephone lines for conversational purposes. It is the purpose of the invention to provide a double supervisory signaling system employing small electric lamps as signals in which there need be but one relay for each lamp and in which, furthermore, the telephonic circuit is inductively balanced, due to the presence of impedance in the connection to both sides of the line circuit. In this respect of providing an inductively balanced circuit the invention shows an improvement over the supervisory signaling system disclosed in patent 688,452, issued December 10, 1901. In the present system, first, directly by the insertion of the associated plug in a line jack, and secondly, by a relay connected between a terminal of the common battery and one of the cord strands, the energization of the relay being controlled by the operative condition of the substation apparatus associated with the line within which the plug has been inserted.



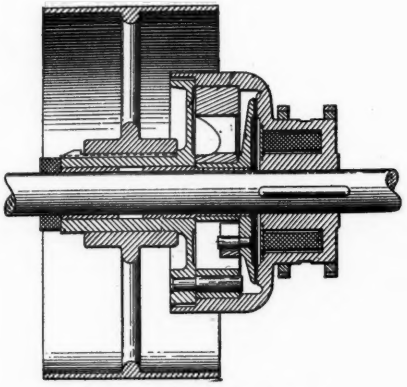
TELEPHONE EXCHANGE SYSTEM (WEBSTER).

Harold D. Stroud, Chicago, Ill., has obtained a patent (816,135, March 27) for an improved telephone exchange system, and he has assigned it to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. This invention relates to telephone exchange systems, and has for its object the provision of improved means, whereby subscribers may be brought into communication. The invention contemplates the provision of boards or sections of boards to which subscribers' telephone lines extend, at some of which connections may be partially completed, while at the remaining sections the connections may be completely established. Generally speaking, the preferred embodiment of one feature of the invention consists in connecting each subscriber's line with two divisions of a board, providing line signaling means at one of the divisions to enable the subscriber to initiate a call, and connecting means extending between the divisions of the board, in combination with means for conveying intelligence between these divisions, so that an operator at one division of the board may form a continuation of the subscriber's telephone line to the other division of the board, at which latter division the connection between the subscribers may be completed. Another feature of the invention may be generally stated to consist in a telephone exchange system in which subscribers' lines extend from substations to an exchange, where the lines are divided up into a number of groups, in combination with means whereby a subscriber whose line is in one group may, in sending a signal, indicate to the operator a particular group containing the line of another subscriber with whom connection is desired, switching apparatus being interposed between the groups and provided with means for conveying signals or other form of intelligence between the groups whereby the operators at these groups may cooperate in effecting a complete connection.



TELEPHONE EXCHANGE SYSTEM (STROUD).

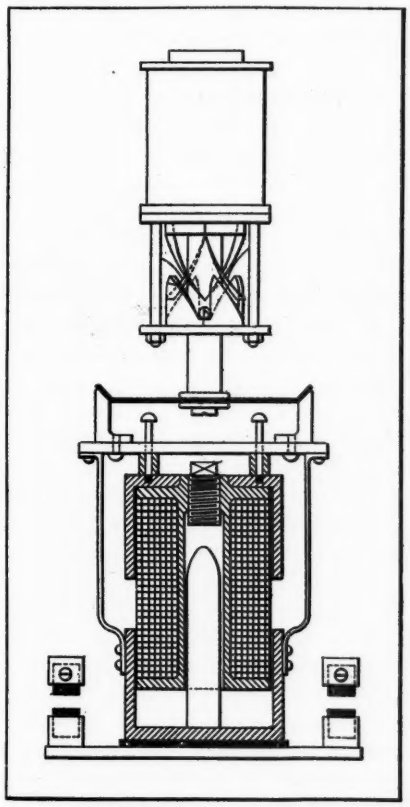
Harry A. Williams, of Akron, Ohio, has obtained a patent (817,210, April 10) for an improved magnetic friction clutch, which he has assigned to the Williams Electric Machine Company, of the same place. This invention relates to improvements in magnetic friction clutches, and relates particularly to a mechanical clutch mechanism, the friction members of which are operated electrically. The object of the invention is the provision of a clutch and operating mechanism therefor located on a shaft, the clutch consisting of but comparatively few elements, being simple in construction and cheap or inexpensive in first cost. A further object is the provision of a compact, durable and efficient mechanism applied directly to a shaft for the purpose of such a device, and the compactness of the mechanism renders the device particularly available for use in a small or limited space. The invention consists of a shaft, a driving member



MAGNETIC FRICTION CLUTCH.

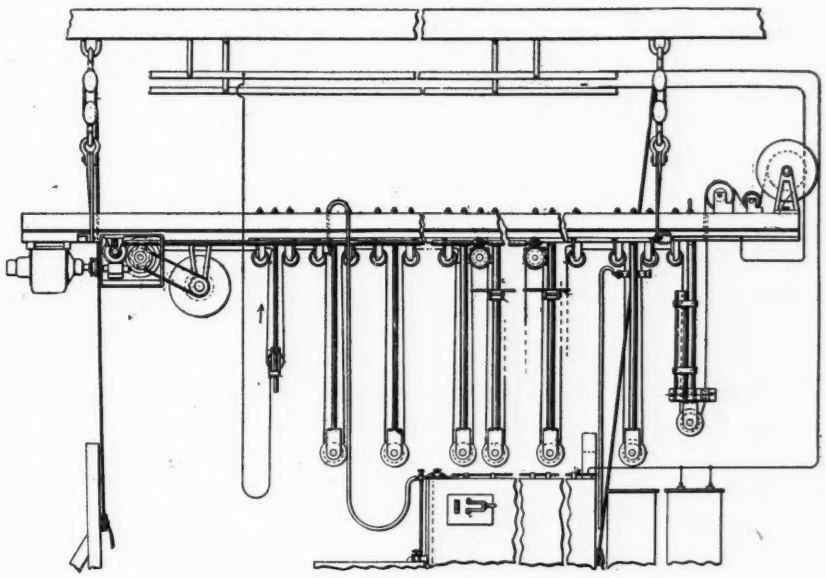
rigid therewith and a driven member loose thereon, an expansible member carried by the driven member, adapted to engage the driving member, a magnetic coil carried by the driving member, and means operated by the coil to expand the expansible member and engage the driving and driven members.

An improved apparatus for commutating currents passing through lamps, etc., has been invented by Campbell Smart, of Swansea, England (817,597, April 10). The invention relates to improvements in commutators for electric currents of combined arc and incandescent lamps, and the objects of the invention are first, to provide means for varying the current passing through the circuits of electric arc and incandescent lamps in such manner that when the arc lamps are burning during evening load the incandescent lamps will be cut off, while to switch on the incandescent lamps (say, for midnight load) the arc lamps are switched off, the apparatus being brought automatically into the proper position for the next operation of switching off the incandescent lamps and switching on the arc lamps for evening load; second, to provide means for automatically correcting any defects in the working of the apparatus caused by the failure of an arc lamp. The invention consists in switching mechanism for a combined arc lamp and incandescent lamp system, a two-part switch for controlling the incandescent circuit adapted to close the circuit when the parts are in alignment, electromagnetic means in the arc circuit for holding the switch open, means for throwing the parts of the switch out of alignment, and auxiliary mechanism controlled by the potential across the arc-lamp circuit for rendering the last-named means ineffectual and for inserting a resistance in the arc circuit in shunt to the arc lamp.



COMMUTATING DEVICE.

Jonas W. Aylsworth, East Orange, N. J., has obtained a patent (817,152, April 10) for an improved apparatus for nickel-plating, which he has assigned to the Edison Storage Battery Company, West Orange, N. J. This invention relates to various new and useful improvements in continuous apparatus for nickel-plating of the general type, in which a continuous strip or a connected series of separate articles is passed continuously through the plating bath. The improved apparatus has been specifically designed for and has been commercially used in connection with the nickel-plating of long perforated strips of thin sheet iron or steel, which are subsequently cut up into blanks and formed into pocket sections for use in the make-up of the improved Edison storage battery; but the applicability of the invention for use in connection with the plating of other articles or a connected series of separate articles will be apparent to those skilled in the art. The invention consists in the combination of a support, means for sustaining and moving the strip to be plated with respect to the support, a plating bath in which the strip may be submerged and through which it may pass, means for applying current to a section of the strip after leaving the plating bath, whereby the section will be heated for the purpose of drying and means for regulating the length of the heated section.



APPARATUS FOR NICKEL-PLATING.

Australian Telephone and Telegraph Service.

It is reported in the *Electrician* (London), April 6, that the newly created position of chief electrical engineer to the commonwealth of Australia post and telegraph department has been conferred on Mr. John Hesketh, the chief electrical officer of the Queensland branch of the service. His headquarters will be in Melbourne.

Commencement on the reconstruction of the Australian telephone systems has been begun, and work is now going on on a line from Melbourne to Sydney. The wires are to be carried on the telegraph poles, the poles to be lengthened where necessary. A double line will be erected. Each wire will weigh 600 pounds to the mile, and as the two cities are over 500 miles apart, over 250 tons of copper will be required. This route takes in about ten considerable towns. It is expected that an extension will be carried to Brisbane. Bids are being asked for new switchboards upon the common battery principle for the Melbourne station. The service at Sydney is to be remodeled at once, and new boards are to be installed for use by July next. It is estimated that this reorganization will cost from $1,000,000 to $1,250,000.

Reviews of Current Engineering and Scientific Literature.

A Model Plating Establishment.

The large plating plant of the National Cash Register Company, Dayton, Ohio, is described briefly here by Mr. H. L. Foote. This department is located on the fifth floor of one of the main buildings, thus getting as much light as possible. The floor space is 360 feet by sixty feet, and is constructed with enough fall from the centre to the walls to prevent water from settling in spots. These floors are of concrete and are drained every forty feet by stand pipes. There are installed eighty-four plating tanks, each of which has a complete regulating equipment and indicating instruments. The total amount of solution employed is 41,400 gallons. Of this there are 40,000 gallons of nickel, 4,400 gallons of acid, 2,600 gallons of copper cyanide, 2,400 gallons of oxide plating, 800 gallons of silver and smaller tanks of zinc and bronze. In addition to this there are several hundred gallons of experimental solutions. The tanks containing the washing water for scrubbing the work tables and sawdust bins are arranged along the outer walls where the light is best. Current for the plating is supplied by three 1,400-ampere generators and one 3,000-ampere machine. These are all partitioned off from the plating room for protection. All the buffing machines, scratch brushes and scouring tables, and even the dynamos, are driven by individual motors. In the acid-dipping room there is an elliptical tank which permits two gangs of men to work, and a second straight tank where one gang can work. All the apparatus is laid out for the convenience of the employés, so as to save time and labor. In conjunction with this plant there is a chemical laboratory. The output of the plating establishment is 275 finished cabinets per day, or, counting all small parts, 250,000 pieces.—*Abstracted from the Metal Industry (New York), April.*

Hydroelectric Installations of Italy.

A review is given here of a paper read some time ago by Signor G. Semenza before the Society of Civil Engineers, of France. The valleys of upper Italy all drain into the river Po, which discharges into the Adriatic. Lake Maggiore and lake Como, two sources of supply for this system, lie, respectively, 432 feet and 490 feet above the points where the rivers flowing from them join the Po. There is thus in this section an immense reserve of water against dry times, making these systems of much importance. It should also be borne in mind that Italy has scarcely any sources of combustible fuel for industrial purposes, and it has been importing coal at the rate of 6,000,000 tons annually, at a value of $5 per ton. These considerations explain the rapid growth and development of the electrical undertakings in Italy. In that country it is good practice to install hydroelectric machinery far beyond that warranted by the average flow of water. The Italian hydroelectric systems may be divided into six groups: those serving Turin; those at Paderno, Zogno and Vigevano, which serve Milan, Monza and the Brianzs; the installations of Vizzola and Turbigo, belonging to the Lombardy company, and supplying Gallarate, Busto and Legnano; the installations of Cellina for Venice; of Morbegno for the Valtellina, and the installations for Geneva. The Turin group is characterized by a plurality of generating stations, which is due to the fact that there is not one hydraulic power sufficient to deal with all the requirements. Works have been constructed on the river Sorura as follows: at Funghera, 3,000 horse-power; at Rusia, 1,500 horse-power; at Ciampernotto, 1,500 horse-power; at Pian Soletti, 1,500 horse-power; on the river Chiusella, 1,500 horse-power; on the river Dora Riparia, 1,800 horse-power at Busoleno. All these streams are irregular in character and do not provide any substantial reservoirs. They depend upon the meteorological phenomena of the district, and to supplement them in times of scarcity of water a large steam station has been erected at Turin. All of these works have been established by the upper Italian Electrical Company. The transmission lines are constructed with metallic supports having spans sometimes 263 feet in length. There are 1,200 miles of lines connecting these stations. The usual pressure on the lines is 25,000 volts. Some of the single lines are fifty-six miles in length. This company has recently acquired a water-power where the fall is 2,820 feet and the discharge of water is fifty cubic feet per second. It is purposed to utilize this power in two falls of 1,460 feet and 1,360 feet, respectively. The Paderno works are on the river Adda, where there is a fall of about 131 feet in less than two miles. This has been utilized in a station containing seven units, each of 1,500 horse-power. The effective fall is 100 feet. This station was laid out primarily to supply Milan, but power from it is now distributed to other towns in the neighborhood. The whole output of this station has been taken up, so that it is being supplemented by a station in Milan having an output of 7,000 kilowatts, which is now being increased to 10,000. It is thought that this system will ally itself with the Conti company, having a station at Brembo, where there are four direct-coupled sets each rated at 2,000 kilowatts. The Lombardy company distributes electrical power to a district of about 760 square miles, lying between the river Ticino and the towns of Varese and Milan. In this section the factories have shut down their own power-stations and are using electric power. At the Vigevano station there is a fall of ninety-five feet, and the normal quantity of water is 2,380 cubic feet per minute, making available 20,000 horse-power. The station contains ten 2,000-horse-power units. The Lombardy company is also equipping a station at Turbigo, on a large canal branching from the Ticino river. There is a fall here of 2,700 feet, and five units are being installed, each rated at 1,050 kilowatts. The transmitting voltage is 11,000. This company is also at work on a site in the Alps, where there is a stream having a fall of 1,300 feet in three miles. This will make available about 20,000 horse-power, though it will be difficult to distribute it on account of the rough country. Venice is served by a power-house on the Cellina river. There is an available fall of 188 feet, with about 635 cubic feet of water. The station contains six 2,600-horse-power units. Geneva is supplied from a station on the southern side of the Apennine mountains. There is a large reservoir having a capacity of 85,000,000 feet on the north side of the mountains. The discharge from this is taken through a tunnel. There is a total fall of 1,210 feet, which is divided into three sections. The same water is piped to Geneva for domestic purposes. Recently the arrangement has been modified and the total fall utilized in a single station where there is an equipment with an output of 6,000 horse-power. One part of this station operates on the Thury system, the other with alternating current at 5,000 volts. The Valtellina railway is supplied from a station at Morbegno, which draws its supply

from the river Adda before entering the lake of Como. The fall is 115 feet, and there are four units with an output of 2,000 horse-power each. There are a number of other smaller installations in Italy, but none of the size of those mentioned.—*Abstracted from the Electrical Engineer (London), March 30.*

An Imperial (British) College of Technology.

A plea is made here for establishing an imperial college of technology in Great Britain, at which the higher branches of engineering may be taught, and where important research work may be carried on. It is said that the many technical schools in Great Britain are greatly hampered by lack of funds and inadequate equipment, and that there is great need for some central school, thoroughly equipped, at which the most advanced work may be taught. Practically no instruction of this character is given at the present time in Great Britain. Such an institution could be formed about the Royal College of Science, which at the present time gives very thorough and advanced instruction in pure and applied science, though it devotes most of the latter work to mining and metallurgy. A committee was appointed two years ago by the minister of education to inquire into the present work of this college and consider in what manner the buildings, staff and appliances may be used to the fullest extent for the promotion of higher scientific studies. The conclusions reached in the report are that the position of Great Britain makes further provision for advanced technical education essential; that at the present time this work is hampered by lack of facilities and by the absence of coordination among existing institutions and an insufficient appreciation on the part of employers of the value of such education, that the opportunities for research in the present technical institutions are inadequate for the industrial needs of the empire. This is due not to the want of ability on the part of instructors, but to the fact that much of their time is absorbed in giving comparatively elementary instruction in pure and applied science. In any institution in which the highest technological education is given the equipment should be adequate for the purpose, and the staff should include men of the first rank in their profession. The committee reports that the London County Council has already promised $100,000 annually for this purpose, and that there is every reason to believe that other public bodies would come forward with like sums. The new institution should be completely under university control; the engineering societies should not have a large share in the management of it. This school should maintain close contact with the different industries of the empire. It should be free from all impeding trammels of the older and little-changing educational methods and requirements which are regulated by other aims.—*Abstracted from the Mechanical Engineer (London), March 31.*

The Electrical Production of Ozone.

Results of an investigation made to determine the effect of varying the form of the electrode and the rate at which air is passed through an ozonizer upon the amount of ozone produced are given here by Mr. A. W. Ewell. Ozone may be produced electrically either by the use of a high potential or by means of an alternating potential. The first method has given a yield of ozone per coulomb of about one-tenth gramme. With atmospheric air and with a pointed electrode connected to the positive pole of a direct-current supply, the best yield in grammes per kilowatt-hour was about twenty-seven. With an alternating current or with a pointed negative pole the yield was about thirteen. The apparatus used in the author's later work consisted of an ozonizer formed of a bottle, into which the two electrodes were inserted. These could be separated by a dielectric plate if desired. Dry air was led into this bottle at one end by means of deflecting plates and was forced to pass between the electrodes. From here it passed out into a sampling bottle, which could be disconnected from the circuit and the amount of ozone contained determined chemically. The current was determined by means of an electrometer measuring the fall of potential across a non-inductive resistance. The rate at which air passed through the apparatus was maintained constant during each experiment. A test made with one plane electrode thirteen centimetres by five centimetres and another electrode having ninety pin points distributed over an equal area gave under the best conditions twelve grammes per kilowatt-hour, corresponding to 0.04 gramme per coulomb. The current varied from 300 to 2,000 micro-amperes. Using two point electrodes similar to the one employed in the above experiment, the yield per coulomb was 0.003, or 1.1 grammes per kilowatt-hour. Two plate electrodes were inefficient, as sparks occurred before the desired brush discharge was appreciable. Plate and gauge electrodes were also unsatisfactory for the same reasons. A series of experiments was then made with two plate electrodes, one bare and the other covered with a dielectric. Other conditions were varied. It was found that the greater the current the greater the ozonizing power of the current, and the greater the deozonizing effect on the ozone already formed. The curves for such conditions show a very decided hump, the maximum outputs being obtained with current densities from 200 to 350 micro-amperes, the outputs varying from 0.07 to 0.2 gramme per coulomb. The greater the velocity of the gas the greater the maximum yield and also the greater the current at which this maximum occurs, and therefore the greater the ozone density or the weight of ozone per litre. It is concluded that for the greatest efficiency a high gas velocity must be used. Increasing the distance between the electrodes lowered the gas velocity for a given flow of gas, and since this exposed the ozone to the deozonizing effect of the current for a longer time, the maximum yield comes at a lower current. It was found that if the mass of gas which flows between the electrodes is the same, the maximum yield of ozone per coulomb is approximately independent of the distance between the electrodes; but if the distance be decreased, the current at which this maximum occurs is greater, and hence the ozone density is greater and therefore a small distance is preferable. It was found that the thickness, and hence the nature, of the dielectric has little or no influence on the yield of ozone, but if both electrodes are covered with the dielectric the yield per coulomb is less and the apparent resistance is greater; therefore, for the greatest commercial efficiency there should be a thin dielectric of high dielectric strength in the gas space between the electrodes. Under the best conditions—that is to say, with plate electrodes and one covered with a thin dielectric—the yield of ozone is over seventy grammes per kilowatt-hour, so that evidently this is better than the direct-current system or the system employing point electrodes. The author has added a note to this article, in which he states that since it was written he has constructed an ozonizer embodying the results of the experiments noted above. The electrodes are straight parallel nickel-plated wires, all in the same plane, alternate wires projecting on each side and being joined to the external electrode. Perpendicular to the plane of the wires and midway between each pair of wires is a flat plate of dielectric sufficiently wide to prevent direct discharge between the wires. Glass and fibre have proved satisfactory for this work. Hard rubber and mica are not. No data showing the performance of this apparatus are given.—*Abstracted from the Physical Review (Lancaster), April.*

Methods of Getting New Business.

A department devoted to the commercial development of Central Stations. Managers are invited to contribute suggestions for methods of increasing the demand for electric service.

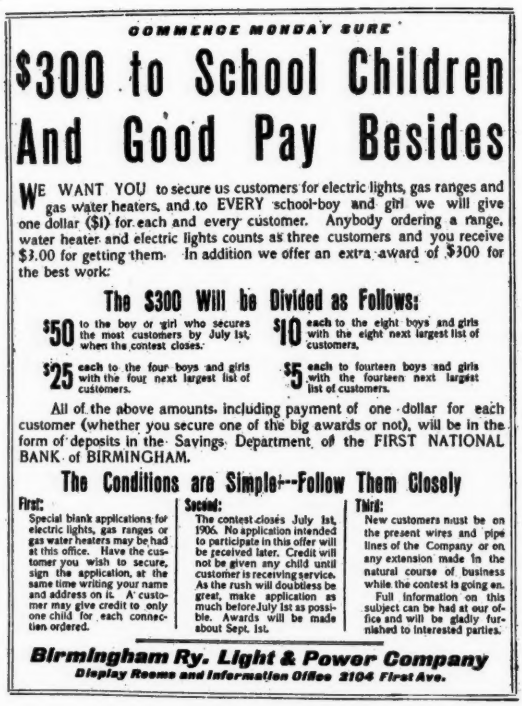
In many instances, while the work involved in a campaign of publicity would be more than any officer of the company, already overburdened with present duties, could undertake, and at the same time not sufficiently extensive to warrant the employment of a special agent, there are institutions which have been organized for this particular work. These institutions undertake complete advertising campaigns, take care of the mailing lists, sending out advertising literature of every description, follow up enquiries and methodically create new interest in and new demands for electric current in any community where the movement may be inaugurated.

A Neat and Attractive Booklet Cover.

It must not be assumed that advertising work can be conducted in haphazard fashion. In advertising probably to a greater extent than in any other form of more or less intangible outlay, method is essential. Because of this, as has been pointed out before, the general manager or other officer, whose time and energy should be devoted to the conduct of the mechanical affairs of the company, should not be expected to work out the details of the advertising propaganda.

That the central station interests are waking up to the necessity for enterprise and initiative in the matter of interesting new consumers is evident from the announcements which are made from time to time of the establishment of special departments, under expert management, for the carrying out of well-laid plans for the dissemination of information concerning the advantages of electricity for divers uses.

Where, however, the publicity will not reach such an extent that a special department is practicable, the agency or syndicate methods are distinctly applicable. The Columbus (Ohio) Railway and Light Company has recently issued a very handsome booklet prepared under these conditions. The advantage of such a service is that the central station has the benefit of expert knowledge in the preparation of the literature and the experience of specialists in utilizing methods of following up and interesting the consumer, so that there is an ultimate effecting of sales among a class of entirely new prospects.



COMMENCE MONDAY SURE

$300 to School Children And Good Pay Besides

WE WANT YOU to secure us customers for electric lights, gas ranges and gas water heaters, and to EVERY school-boy and girl we will give one dollar ($1) for each and every customer. Anybody ordering a range, water heater and electric lights counts as three customers and you receive $3.00 for getting them. In addition we offer an extra award of $300 for the best work.

The $300 Will be Divided as Follows:

$50 to the boy or girl who secures the most customers by July 1st, when the contest closes.

$10 each to the eight boys and girls with the eight next largest list of customers.

$25 each to the four boys and girls with the four next largest list of customers.

$5 each to fourteen boys and girls with the fourteen next largest list of customers.

All of the above amounts, including payment of one dollar for each customer (whether you secure one of the big awards or not), will be in the form of deposits in the Savings Department of the FIRST NATIONAL BANK of BIRMINGHAM.

The Conditions are Simple---Follow Them Closely

First: Special blank applications for electric lights, gas ranges or gas water heaters may be had at this office. Have the customer you wish to secure, sign the application, at the same time writing your name and address on it. A customer may give credit to only one child for each connection ordered.

Second: The contest closes July 1st, 1906. No application intended to participate in this offer will be received later. Credit will not be given any child until customer is receiving service. As the rush will doubtless be great, make application as much before July 1st as possible. Awards will be made about Sept. 1st.

Third: New customers must be on the present wires and pipe lines of the Company or on any extension made in the natural course of business while the contest is going on.

Full information on this subject can be had at our office and will be gladly furnished to interested parties.

Birmingham Ry. Light & Power Company

Display Rooms and Information Office 2104 First Ave.

A Good Premium Ad. from Birmingham, Ala.

The Birmingham Railway, Light and Power Company also believes in the premium method of securing new customers. Herewith is reproduced an advertisement from one of the local newspapers offering premiums to the school children for their efforts in promoting the sale of the utilities which this company supplies. This is a method of reaching directly into the homes of those whose interest is desired, and is probably one of the most effective that can be devised. The contest closes on July 1, and the results of this campaign will be watched with considerable interest.

INDUSTRIAL SECTION.

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS.

Westinghouse Machine Company Changes.

On account of the rapid expansion of the business of the Westinghouse Machine Company, the board of directors has decided to enlarge the executive organization by increasing the number of vice-presidents from two to four, and has elected Mr. E. H. Sniffin and Mr. Arthur West to fill the new offices of third and fourth vice-president, respectively.

Mr. Sniffin will be in charge of the sales department as heretofore, his field of work not being altered in assuming the new title.

Mr. West, who has been chief engineer of the company, still retains that title and position.

Mr. William A. Bole, in consequence of his election to the vice-presidency of the Westinghouse Foundry Company, has resigned his position as manager of works of the Westinghouse Machine Company in order that he may better serve the interests of the Foundry company, of which he assumes the entire management.

The Westinghouse Machine Company, however, retains Mr. Boles as consulting engineer, availing itself of his services and counsel on important work, which his ripe experience has made peculiarly valuable.

Mr. Henry L. Barton, formerly general superintendent of the East Pittsburg works of the Westinghouse Machine Company, has been appointed manager of works.

Water-Power Development at Clarke City, Quebec.

The North Shore Power, Railway and Navigation Company is developing a water power on the St. Marguerite river, Quebec. A short description of the work is given in the *Canadian Electrical News* for March. A dam is being built here which will consist of a headgate wall 485 feet long, varying from thirty-two to forty-eight feet in height and an overflow dam 690 feet in length. This will give a working head of about fifty-three feet. Seven penstocks are being erected for conveying the water to the turbines. Four of these are fifteen feet in diameter, one eight feet and two seven feet six inches. The turbines will have a combined output of 22,400 horse-power. Power will be used in a large pulp mill and for furnishing current for many purposes at Clarke City. The company owns important deposits of iron, copper, gold and other minerals, and will use electric motors in developing these mines.

Manhattan Flush Receptacle and Separable Attachment Plug.

The accompanying illustration, Fig. 1, shows the Manhattan flush receptacle, which has been produced as the result of great care in design and construction. Both plug and receptacle box are liberally proportioned and made from the best quality of vitrified porcelain. With this design unusually ample contact area is secured,

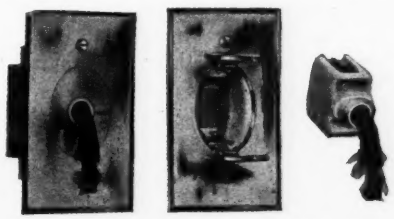


FIG. 1.—MANHATTAN FLUSH RECEPTACLE.

while the possibility of short-circuiting or grounding the current by the plug terminals coming in contact with the face plate as the plug is inserted or withdrawn is entirely avoided. The plug terminals are depressed to accomplish this. The interior of the plug is larger than usual.

Both plug and box terminals are made from very high-grade phosphor bronze, ensuring uniform contact.

The surface plates are supplied in twelve

FIG. 2.—MANHATTAN SEPARABLE ATTACHMENT PLUG.

standard finishes, any of which will be furnished as specified.

The small doors are provided with springs, which hold them open or closed as the case may be.

Fig. 2 shows the Manhattan separable attachment plug. Both plug and cap are generously proportioned and made from the best grade of porcelain. The spring contact slips are of phosphor bronze, and the brass terminals are held securely. The contact "well" in the plug is reenforced by a heavy division wall, and ample and positive contact area is ensured by the construction. The special feature of this device is that it will separate at any angle. A pull on the cord in any direction will cause the plug and cap to separate instantly without imposing the slightest strain on socket or cord, no matter how or where the socket may be located or supported.

These devices are made by the Manhattan Electrical Supply Company, New York city.

The Effect of Sleet on Different Types of Third Rail.

The effects of a sleet storm on several types of third rail installed for experimental purposes on a section of track of the New York Central & Hudson River Railroad are described briefly in the *Railroad Gazette* for April 13. The storm occurred on March 3. There was a light rain followed by hail, the temperature ranging from twenty-eight to thirty-three degrees Fahrenheit. There was an east wind with a velocity of two miles an hour. Sleet began to form at nine in the morning, and continued to form throughout the day, the quality of the sleet varying with temperature. In thickness it averaged about one-quarter of an inch. Two types of overrunning rail were tested. On the unprotected overrunning rail the sleet was so bad that after three hours it was impossible to run. On the inclined top protection overrunning rail, on the section of the track where the wind could get at the side of the rail, the sleet formed at some points entirely over the top of the rail. At such places contact shoes arced badly. Three types of underrunning rail were tested. On the underrunning rail with wooden protection the drip carried the sleet off the edge of the side board, and no sleet formed on the rail. On the underrunning rail with fibre protection the drip was carried off by the fibre, and no sleet was formed on the rail. On the underrunning rail with mica compound insulation, except on the edges of the rail, no sleet formed. These results seem to show that under the conditions prevailing on that day the underrunning rail was superior to the overrunning type.

Some New Small Electric Tools.

The General Electric Company, Schenectady, N. Y., has recently developed several small motor adaptations which are quite interesting as showing how thoroughly electrical manufacturers are in touch with the need of the general public outside of the purely electrical fields. The use of electric power is daily being extended by progressive central stations into almost every nook and corner of their customers' premises. Motors for small labor-saving machines enable the jeweler, dentist, grocer, butcher, and even the customer, the householder, to draw on his electric lighting circuit for economical and convenient power whenever and wherever required to meet daily needs.

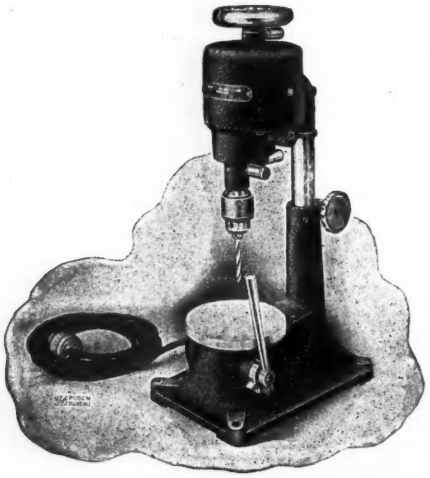


FIG. 1.—BENCH DRILL.

The General Electric Company's latest development along these lines includes an electrically driven bench drill suitable for small work, a portable electric breast drill for the same range of requirements, and an electric buffing and grinding outfit for household use. The bench drill has been particularly designed for the use of jewelers, repair men and manufacturers who have a large amount of drilling on small work or otherwise where the drilling service is not severe.

Machine and general repair shop men as well as manufacturers are becoming better informed and more convinced of the advantages of the electric motor for driving their machinery, and realize that large savings in both time and money are possible in just those operations for which the electric bench drill is designed.

The bench drill shown in Fig. 1 is furnished with a vertical motor mounted on the top of a column sliding in a socket cast integrally with the base, in which it can be adjusted for various heights. The motor body or head is also adjustable radially for drilling position.

The whole outfit rests on a broad base about six by sixteen inches, which gives the desired stability. The minimum height is sixteen inches when the motor arm is in the lowest position and the maximum height is twenty-two inches when the motor arm is fully raised, thus giving a range of six inches through which the motor body may be raised or lowered. The work is fed to the drill by raising a circular table which is operated by a lever with a range of one and one-quarter inches vertically.

The motor is series wound and can be supplied with 115 or 230-volt winding, for use on direct-current circuit only. A single gear reduction is provided between the armature shaft and drill spindle. The hand wheel mounted on the armature shaft at the top is convenient for turning the spindle and adds a flywheel effect to the spindle as well, thereby insuring a smooth steady rotation of the drill. The amount of power required in the operation of the drill naturally varies with the amount of work performed, but in no case is it excessive. The largest drill the chuck will hold is twenty-one-sixty-fourth inch diameter and from this all sizes down to No. 40.

The bearings are provided with self-oiling cups which require attention only every three or four months. The outfit includes a chuck of standard design, ten feet of attaching cord and Edison attaching plug. Drills are not supplied with the outfit. The weight of the bench drill complete is about forty pounds, which ensures firmness and rigidity. The outfit is finished in black japan with nickel-plated trimmings.

The motor used in the portable electric breast drill shown in Fig. 2 is similar in size and construction to that used with the bench drill just described. The tool is provided with a switch in the body of the motor so conveniently arranged as to bring the drill under absolute control of the operator. This switch is well protected from damage, of suitable design and sturdy construction. The weight of the breast drill is sixteen pounds complete and it measures thirteen inches long by five inches diameter. With the outfit is furnished chuck and extension cord with Edison attaching plug permitting a range of operation within a radius of ten feet from the source of current supply. The oiling of the bearings is effected through protected oil holes which replace the self-oiling features of the bench drill motor. The use of a self-oiling bearing in which oil is stored is not practical with these drills, as the breast drill is used in all conceivable positions and oil could not be prevented from escaping out of the reservoirs. On this account the bearings of the breast drill must be oiled frequently.

The new domestic grinding and buffing outfit, Figs. 3 and 4, have been especially designed for grinding knives, scissors and other similar edged tools, and for polishing small silverware, jewelry and other like articles. A grinding wheel of suitable character to insure a smooth cutting edge without the use of a second sharpening is interchangeable with the buffing wheel. These outfits are adapted for the intermit-

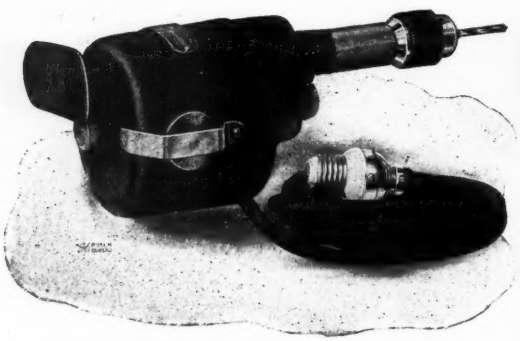


FIG. 2.—BREAST DRILL.

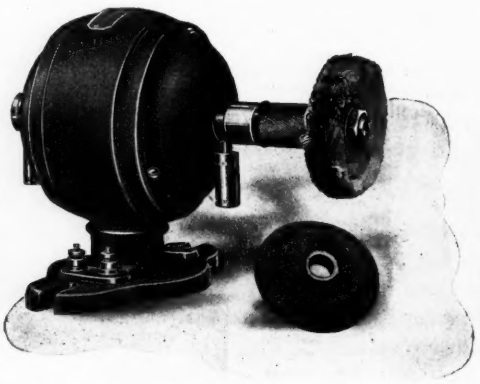


FIG. 3.—GRINDING AND BUFFING MACHINE.

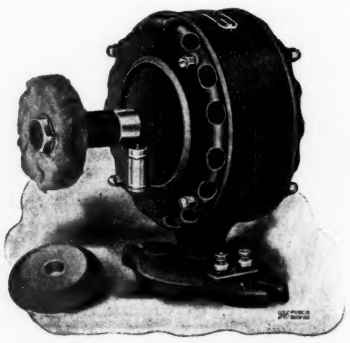


FIG. 4.—GRINDING AND BUFFING MACHINE.

tent service required in the ordinary household, but are not suitable for the heavier continuous work which is required by jewelers, dentists, etc. Other and larger outfits are furnished by the General Electric Company for this more exacting service.

The household outfit consists of motor with shaft extended two inches from end of bearing to inside of wheel, the necessary washers and nuts for holding the wheel in place, one rag wheel of three and one-half inches diameter, one three-inch emery wheel, one-half inch thick with five-eighths inch bevel face, together with attaching plug with ten feet of cord. These outfits are furnished for 110 volts direct-current and 110 volts alternating-current, and can be specially wound for 220 volts.

The alternating-current motor weighs about twenty-five pounds. The direct-current motor is much lighter, weighing but fifteen pounds. Both motors are very simple, requiring no more attention in service than a fan motor. In connecting to source of current supply the cord is attached to the binding posts of the motor and the plug inserted in the nearest socket at which the proper current is available.

Steam Turbine in Siam.

One of the most progressive of the independent principalities of Asia is the little kingdom of Siam, on the Indo-Chinese Peninsula. In the principal city, Bankok, is a modern electric railway power plant, operated by the Siam Electricity Company and equipped with reciprocating engines and generators. Because of the increased demand for power, an additional unit has become necessary and a Curtis steam turbine has been decided upon as most suitable. This is a 500-kilowatt, 575-volt machine, built by the General Electric Company, of Schenectady, N. Y. The boiler plant for this station is unique in that paddy husks are burned in place of coal. The fuel is brought down the river from the rice field in flat-bottomed boats to the power-house and unloaded directly into the boiler-room by an elevator and belt conveyor, operated by several direct-current 500-volt General Electric Company motors of the CE type. This method of using rice husks for fuel is an economic utilization of a waste product similar to the use of the crushed sugar cane, or bagasse, on sugar plantations.

The Bristol Portable Recording Gauges.

Within recent years there has been evident a demand for a portable recording pressure gauge free enough from delicate mechanism for the ordinary workman to manipulate it successfully with reasonable care. To meet these requirements the Bristol Company, Waterbury, Ct., has placed on the market a modification of its well-known recording gauge for portable service. In these portable gauges the metal case has been omitted, the pressure tube and clock for driving the chart being mounted on a light aluminum back, which, in turn, is mounted in a wooden carrying case designed with special reference to ease in handling and making connections to the source of pressure.

For recording pressures which may exceed five pounds per square inch the type of gauge shown in Fig. 1 is employed. A special flexible connection with unions is supplied to facilitate connecting to piping at various angles.

Where a permanent installation is necessary this instrument could be used to advantage, as, for example, on boiler tests, water mains or fire protective systems, where a few accurate and continuous records would settle disputes or lead to better service.

For gas pressures in outlying districts, mine ventilating pressures, draught or light vacuum, the gauge shown in Fig. 2 is adapted, since it is capable of recording pressures as low as one-twentieth inch head of water. Connection is readily made by means of a rubber hose to a nipple which projects through the side of the case. A clamping device is employed to hold the pressure tube rigidly when the gauge is being transported.

These gauges weigh about one-third as much as the standard gauges mounted in a carrying case. Both forms are furnished with leveling screws to facilitate the adjustment of the instrument. Provision is also made for carrying a supply of charts and ink with each gauge.

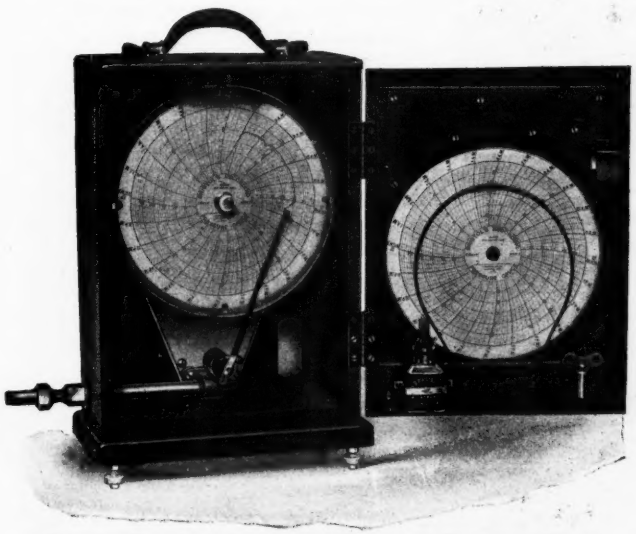


FIG. 1.—PORTABLE GAUGE FOR PRESSURES EXCEEDING FIVE POUNDS PER SQUARE INCH.

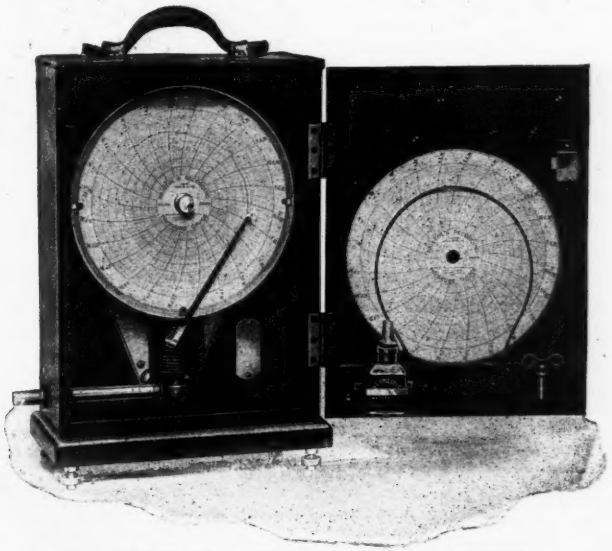


FIG. 2.—PORTABLE GAUGE FOR VERY LOW PRESSURES.

The Cincinnati Fall Festival.

The Cincinnati Fall Festival will be held from August 26 to September 22 in the music hall, exposition buildings and Washington Park, Cincinnati, Ohio. The festival is held under the direction of the Cincinnati Fall Festival Association Company, which was organized in 1900 for the sole purpose of promoting the interests of Cincinnati. Manufacturers throughout the United States are invited to make exhibits during the festival.

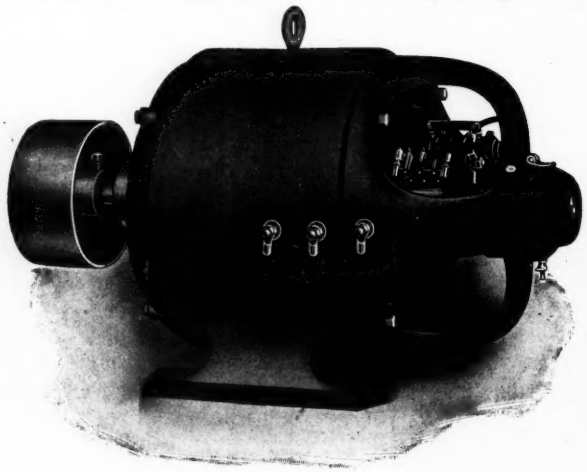
An important feature will be the electrical exposition, where every effort will be made to create a historical exhibition and at the same time show the develop-

ment of the industry with exhibits of modern apparatus of every description. Arrangements have been made with the Cincinnati Gas and Electric Company to furnish current at a nominal price, and the committee in charge of the electrical exhibits announces every facility for proper installation and operation.

The Dynamos and Motors of the Elektron Manufacturing Company.

The accompanying illustrations show some of the details of the type H semi-enclosed motors and dynamos made by the Elektron Manufacturing Company, Springfield, Mass. These motors have been carefully designed along lines which have proved satisfactory through years of experience. This line of motors is particularly adapted to the driving of various machinery by direct-connection through either worm or spur gear, being entirely self-contained and sufficiently enclosed for protection from mechanical injury, and at the same time sufficiently open for ventilation and for access to the rocker arm, brushes, etc. For the same reason the dynamos are adapted for direct-connection to engines of various styles. The field magnet is of steel, with four pole-pieces cast integral with the ring, which has flanges on each side, carefully machined. The cast-iron hangers are attached to these flanges by four bolts.

The journal boxes and oil wells are cast integral with the hangers. The four bolt holes are accurately spaced, so that in case the motor is to be mounted on a side wall the hanger may be moved one-quarter of a revolution around the field ring, thus keeping the oil wells on the under side of the shaft. When the machine is to be located on the ceiling the hanger is rotated one-half a revolution upon the field ring. This simple arrangement adapts the machine to a very large range of work without any change. The field coils are carefully wound and thoroughly insulated.



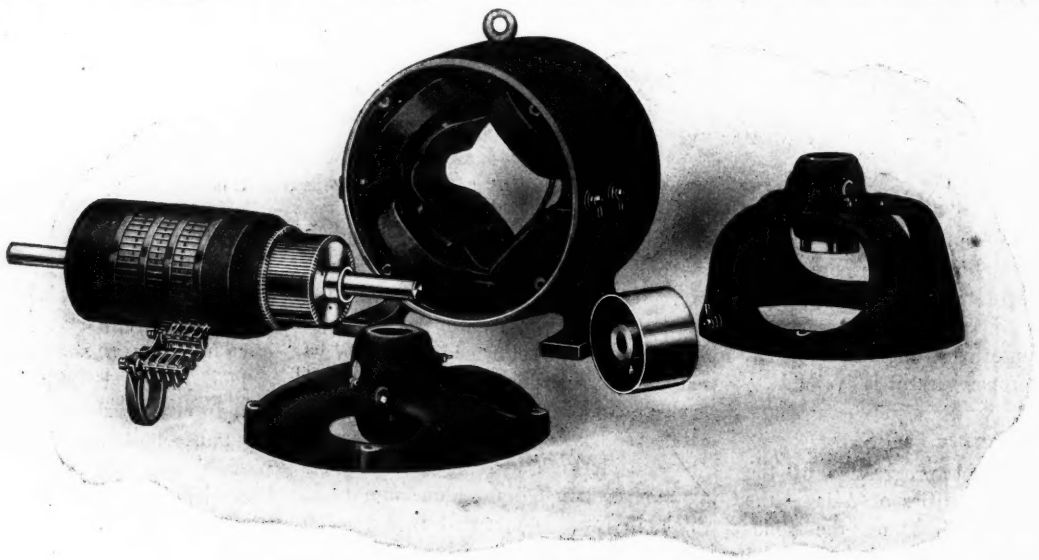
TYPE H SEMI-ENCLOSED MOTOR.

The armature is made up of steel sheets carefully selected with a view to the highest electrical properties. The core is secured to the armature shaft, so that it is practically impossible for it to get loose or move. The coils are form-wound and heavily insulated. The core slots are also heavily insulated, and the coils secured with great care. A feature of these armatures is the metal flange which projects from the spiders, supporting the core. This flange not only affords a support to the coils and a protection to them from mechanical injury, but also protects them from oil and dirt. Armature ventilation is secured by openings in and through the core and coils, through which the air is constantly forced by the rotation of the armature.

The commutators are large in size, the design affording ample insulation and freedom from commutator troubles. The outer end of the commutator is perfectly smooth and can not collect dust or oil, eliminating short-circuits and burnouts. On the inner end full protection is secured by allowing the mica segments to project well beyond the copper, as well as by the canvas covering of the coils. The commutator bars are of pure lake copper, drop-forged to uniform section, and the best quality of mica is used for the insulation. The commutator design is such that the shell secures a rigid hold on every bar at each end, retaining the commutator in true cylindrical shape and preventing the occurrence of high or low bars. The commutator is assembled under pressure, and after being secured is raised to a high temperature. After this it is cooled and all slack is taken up by the application of pressure.

The shaft is of the best grade high-carbon steel of ample cross-section. The bearings are fitted with phosphor bronze of large surface, and are lubricated by rings resting upon the shaft and dipping into oil wells.

The rocker arm is secured on the inside hub of the front bearing by a set screw and is set in proper position before the machine is shipped. The brushes are of carbon and are self-adjusting, requiring no trimming and running practically noiselessly. The contact between the carbon and the holder is positive, there being no sliding contacts.



DETAILS OF TYPE H SEMI-ENCLOSED MOTOR.

CURRENT ELECTRICAL NEWS

DOMESTIC AND EXPORT.

NEW POWER-PLANT FOR MINNEAPOLIS, MINN.—The Mississippi River Power Company, recently incorporated with $50,000 authorized capital, is planning to generate 12,000 horse-power by dams at Clear Water and Monticello, for transmission as electric power to Minneapolis and St. Paul.

MICHIGAN TRACTION MERGER—The properties of the Michigan Traction Company have been absorbed by the Michigan United Railways, incorporated for $5,000,000 at Lansing, Mich. It is understood that many improvements will be made, notably on the Kalamazoo and Battle Creek city lines, as well as several interurban systems. The track between Kalamazoo and Augusta will be straightened so as to afford faster service.

TELEPHONE SYSTEM FOR MILWAUKEE, WIS.—The West Shore Telephone and Telegraph Company, for which the city council of Milwaukee, Wis., has voted a franchise, expects to begin at once the construction of a $3,000,000 system in Milwaukee, which will also connect with the independent lines throughout the state and elsewhere. The company plans to build a central exchange and four other exchanges in outlying parts of the city.

POWER COMPANY FORMED—The New York & Ontario Power Company has been formed for the purpose of generating electricity for light, heat and power, and will supply current to Plattsburg, Ogdensburg, Watertown, Rome, Syracuse, Oswego and the villages in the counties of Franklin, St. Lawrence, Jefferson and Oneida. The capital stock is $2,000,000. The directors are David R. Crichton, Jr., John W. Liston and William F. Burt, of Ogdensburg.

INDIANA TRACTION MERGER—It is reported from Indiana that negotiations have been opened for the consolidation of the Evansville Gas and Electric Light Company, the Evansville Electric Railway Company and the Mount Vernon, Princeton, Boonville and Rockport traction lines and other lines in process of formation. Farson & Son, of Chicago, Ill., who own $306,000 of the stock of the gas company, have made an offer to the E. W. Clark syndicate, of Philadelphia, Pa., and it is believed that the transaction will be put through.

CANADIAN GENERAL ELECTRIC COMPANY TO ERECT BLAST FURNACES—It is announced that interests identified with the Canadian Foundry Company, a subsidiary of the Canadian General Electric Company, are organizing a company which will erect blast furnaces at a point on the Niagara peninsula. The present blast furnaces in Canada are unable to meet the demand, and firms requiring pig iron are compelled to import it. The initial capacity of the new industries will be about 200,000 tons a day. The provisional capital will be $1,000,000.

MARCONI WIRELESS TELEGRAPH COMPANY—At the annual meeting of the Marconi Wireless Telegraph Company in Jersey City, N. J., April 17, the following directors were elected: H. Cuthbert Hall, Major Samuel Flood-Page and James N. Greenshields. The acting manager of the company, John Bottomley, reported that 15,076 messages, containing 203,276 words, were sent and received by the company during the past year. Gross earnings from these were $32,209. In the year 1904-5 the messages numbered 8,314, containing 122,424 words, and the gross earnings were $15,689.

POWER-PLANT AT ANTHONY SHOALS, GA.—The Shoals Milling Company has petitioned the Superior Court for the privilege of changing the name of the corporation to that of the Anthony Shoals Power Company, and also for the privilege of increasing the capital stock from $100,000 to $5,000,000. The company owns the water-power at Anthony Shoals in Wilkes county, Ga., which is recognized as one of the best water-powers in the state. It is the purpose of the promoters of the property to build a large dam across Broad river at Anthony Shoals, erect a power-house and transmit the power generated to nearby towns and cities, to be used for commercial purposes.

TELEPHONE COMBINATION—At a meeting on April 11 of the directors of the Consolidated Telephone Companies of Pennsylvania, at Bethlehem, Pa., a lease of three telephone companies for 999 years was effected. The companies in this consolidation are the Easton & Bethlehem, the Warren, and the United States Long-Distance Telephone Company, operating at Bethlehem, Easton and Phillipsburg, Pa., and Alpha, N. J., and in the surrounding territory of Northampton and Bucks counties, Pa., and Warren county, N. J. The leased companies have 250 miles of wires and fifty miles of cables.

PENNSYLVANIA RAILROAD MAKES A TUNNEL CONTRACT—The directors of the Pennsylvania Railroad Company have authorized President Cassatt to enter into an agreement with the Hudson River Tunnel Company for the joint use of the railroad company's right of way between Jersey City and Newark. This is the initial step towards an extensive rapid transit system between those cities. Under the terms of the contract to be entered into by the two corporations the Hudson River company is to build an electric railway between Newark and Jersey City for the commuters who travel between Newark and New York. The tracks of the new line will parallel the Pennsylvania tracks into Jersey City, where they will then descend into the tunnels from a point under the railroad station in Jersey City to the foot of Cortlandt street in New York city.

CHICAGO SANITARY CANAL—Robert R. McCormick, president, and Isham G. Randolph, engineer, of the Chicago Sanitary Canal, appeared before the Senate Foreign Relations Committee, Washington, D. C., on April 11, in favor of a bill providing for the deepening of the canal and the dredging of the Illinois and Mississippi rivers so as to furnish a twenty-foot waterway from Chicago to St. Louis. The bill provides for the issue of $60,000,000 of bonds to pay for all the work except dredging, and the three power companies which are given the exclusive right to the water-power developed are to pay two per cent interest on the bonds for ninety years. The canal engineer desires to use 14,800 cubic feet of water from Lake Michigan, but the International Waterways Commission will not consent to the use of more than 10,000 cubic feet per second, on the ground that any amount in excess would seriously injure the flow over Niagara falls. No action was taken by the committee.

SETBACK FOR INDEPENDENT TELEPHONE COMPANY IN NEW YORK CITY—Under an opinion rendered by Corporation Counsel Delany on Tuesday, April 17, to the Department of Electricity, Water and Gas, of New York city, the Great Eastern Telephone Company will have to go to the Board of Estimate for a new franchise for the establishing of a new telephone system in New York city. The corporation counsel has declared that the company's claim to a franchise through the New York Electric Lines Company is worthless, denying the corporate existence of that company. The New York Electric Lines Company is owned by the Great Eastern Telephone Company, of which D. A. Reynolds is president. It is under the franchise of the former company, granted by the board of aldermen of the old city of New York in 1883, that the Great Eastern company plans to engage in the telephone business in Manhattan and the Bronx. Mr. Delany concludes that the original grant was a mere license, and that it has become invalid through non-use; that the grantee had no power to transfer its franchise, and that all the franchise rights are forfeited. To do away with any legal complications, he recommends that all the old grants be formally revoked by Commissioner Ellison. The company will institute mandamus proceedings to compel Commissioner Ellison, of the Department of Water Supply, Gas and Electricity, to grant a permit for it to open streets, now that Corporation Counsel Delany has ruled against its application.

NEW INCORPORATIONS.

YANTIS, TEX.—Yantis Telephone Company. $10,000.

DANVILLE, IOWA—Mutual Telephone Company. Increased to $20,000.

LINCOLN, NEB.—Johnson County Telephone Company, Smartville. $50,000.

MADISON, WIS.—Browntown Telephone Company, Browntown, Green county. $5,500.

ST. PAUL, MINN.—Lewiston Telephone Exchange Company, Lewiston. Capital increased from $10,000 to $25,000.

APPLETON, ILL.—Persifer Telephone Company. $1,200. Incorporators: F. S. Beamer, R. V. Wyman and J. H. England.

HENNESSEY, MO.—Oakview Rural Telephone Company. $250. Incorporators: S. A. Clark, Rhodes Clements and H. W. Fritz.

HANNIBAL, N. Y.—Hannibal Telephone Company. $5,000. Incorporators: C. A. Cox, E. W. Rice, M. H. Minar, Hannibal, N. Y.

PHILADELPHIA, PA.—American Town Lighting Company, Philadelphia. To supply towns and cities with light, heat and power. $500,000.

NEW CASTLE, PA.—The Ohio Valley Traction Company. To construct a trolley road through Allegheny, Beaver and Lawrence county. $50,000.

LINCOLN, NEB.—Wilbur Telephone Company. $2,800. Incorporators: W. H. Bueton, F. M. Griffith, A. Grier, Ferdinand Thim and John Harder.

DOVER, DEL.—The Delaware Electric Transmission Company. To generate, transmit and distribute electric current for light, heat and power. $30,000.

PEORIA, ILL.—Interurban Railway Company. $100,000. Incorporators: the Hon. B. B. McKinley, W. J. Ferris, Charles Zilley, B. E. Bramble and G. W. Mattis.

HANNIBAL, N. Y.—Bethel Telephone Company. $2,000. Incorporators: L. D. Harman, L. J. Sweet and H. W. Robinson, all of Martville, N. Y., and others.

LITTLE ROCK, ARK.—The Citizens' Telephone Company, of Waldron. $5,000. Incorporators: W. A. Streator, W. L. Compere, H. C. Stanton, W. H. Plummer.

GUTHRIE, OKLA.—The Aline Farmers' Mutual Telephone Company, of Aline. $2,000. Incorporators: H. C. Geist, B. A. Reiner, S. F. Geist and George Brown.

ST. LOUIS, MO.—Farmers' and Merchants' Telephone Company, of Granite. $5,000. Incorporators: O. S. Laswell, John Willis, Howard Arnett and J. F. Vandyke.

COLUMBUS, OHIO—Townsend Telephone Company, Huron county. $10,000. Incorporators: C. B. Canfield, C. L. Moore, George W. Helling, A. D. Bargus and George E. Stacey.

CAMDEN, N. J.—The Southern Public Service Corporation. To establish gas, electric and water plants. $600,000. Incorporators: H. Bird Cassel, George H. B. Martin, Andrew N. Walker.

PENN YAN, N. Y.—Yates County Telephone and Telegraph Company. $5,000. Incorporators: Frank E. Spencer, Benton, N. Y.; Fred Culver and M. L. Spooner, Penn Yan, N. Y., and others.

OMAHA, NEB.—The Citizens' Telephone Company, of Atkinson, Holt county. $5,000. Incorporators: James F. Brady, C. E. Haven, J. A. Robertson, R. O. Clifford, W. L. West and F. H. Swingley.

ALBANY, N. Y.—Clinton Construction Company, Brooklyn. Construction and contracting railroads, gas and electric works, etc. $5,000. Incorporators: W. B. Mount, W. N. Benkart, W. J. Bagnell, Brooklyn.

GUTHRIE, OKLA.—The Newkirk Commercial Mutual Telephone Company. $12,000. Directors: C. A. Johnson, H. M. Ziegler, A. J. Green, J. F. Hufbaer, G. L. Milam, W. S. Cline and A. C. Harrington, all of Newkirk.

ALBANY, N. Y.—The Rural Home Telephone Company, of Nassau, Rensselaer county. $50,000. Directors: I. R. Coughtry, E. M. Woodard, P. J. Callan, George Fleming, W. B. Harris, J. E. Carhart, R. I. Hopwood, Albany.

MADISON, WIS.—Sturgeon Bay & Northern Traction Company, Sturgeon Bay. To build an electric car line from Sturgeon Bay to the town of Liberty Grove. $25,000. Incorporators: Joseph A. Becker, J. Mosely and E. C. Devlin.

CAMDEN, N. J.—The Alton & Suburban Company. To purchase and operate street railways, electric railways, electric light, gas, heat and power companies. $3,750,000. Incorporators: F. R. Hansell, W. F. Eidell, George H. B. Martin.

ALBANY, N. Y.—Massapequa Gas, Electric Light and Power Company. To operate in the towns of Hempstead and Oyster Bay and vicinity. $50,000. Directors: J. S. Lilly, of New York city, and G. F. Parmelee and S. M. Beard, of Yonkers.

TOPEKA, KAN.—Douglas Township Telephone Company, St. John; $1,280. Medicine Lodge Telephone Company, Medicine Lodge; $15,000. Shipton Telephone Company, Shipton, $3,000. Farmers' Mutual Telephone Company, Lucerne; $2,050.

ST. PAUL, MINN.—Sanborn Telephone Company, Sanborn. $15,000. Incorporators: Henry J. Fink, F. W. Silvers, George A. Dreblow, H. K. Schroeder, H. Schwerdtfeger, Sanborn; Emil Gerth, Germantown; Charles Goehring, Charlestown.

RALEIGH, N. C.—The Water Power and Electric Company, of Hickory, N. C. For the construction of dams and power plants and for lighting the counties of Catawba, Caldwell, Alexander, Lincoln and Cleveland. $250,000. Incorporators: M. B. Thornton, C. F. Blalock, C. M. Hardin, and B. F. Campbell, of Hickory.

CLAYTON, MO.—The Orrville-Bellefontaine Mutual Telephone Company. $4,000. Stockholders: Peter W. Gluck, Ernest Bayer, J. L. DeFoe, William E. Sutton, George Glaser, Henry Wetzel, D. Mueller, William H. Long, P. A. Steffan, Robert Terry, Jr., Edward Burkhardt, Ernest and Edward Eberwein, Oscar Linss, Gottlieb Bayer, Ernest Muellor, John Bayer, Charles E. Kelpe and William Schultze.

BANGOR, ME.—Gardiner, Richmond & Topsham Street Railway. To build an electric line from Gardiner, through Richmond and Bowdoinham to Topsham, where it would meet the Lewiston, Brunswick and Bath road, a distance of thirty-two miles. $180,000. Promoters: Fred S. Bradstreet, Freeman Patten, Charles S. Whitney, Harry B. Lawrence and Fred S. Thorne, all of Gardiner; L. C. Ballard, of Farmingdale and Noble Maxwell, of Richmond.

SPRINGFIELD, ILL.—Springfield & Southeastern Traction Company. To be constructed from Springfield in a southeastern direction, through the counties of Sangamon and Christian to Pana, Ill., then in a southerly direction through the counties of Christian, Shelby and Fayette to Vandalia, Fayette county, Ill., and from Pana, Christian county, Ill., in a northerly direction through the counties of Christian, Selby and Macon to Decatur, Ill. $250,000. Incorporators and first board of directors: L. A. Shadburne, P. Chase, T. J. Finn, J. J. Finn and M. P. Vale, all of Chicago.

PITTSBURG, PA.—Ligonier Street Railway Company, Ligonier, Westmoreland county. To build from Ligonier to Latrobe through the borough of Ligonier and the townships of Derry, Unity and Ligonier a distance of ten miles; $60,000; directors: J. W. Williams, H. A. Phillips, Allegheny; F. O. Adams, C. A. Baltzell, W. L. B. Myers, Pittsburg. Canonsburg & Upper St. Clair Street Railway Company; to build a line ten miles long from Canonsburg through Chartiers and Cecil townships to North Strabate township to Peters township, and Upper St. Clair township, Allegheny; $58,500; directors: S. L. Tone, J. L. Foster, A. W. Stevenson, W. G. Whitlinger, W. B. Carson, Pittsburg. Uniontown & Masontown Street Railway Company; to build a line twelve miles long from Uniontown to South Uniontown; thence through High House to Leckrone, Masontown, Nicholson township and return; $72,000; directors: C. C. Gadd, Sykesville; M. A. Doherty, James M. Garrettson, Jr., J. Levi Kelly, Pittsburg. St. Clair & Sodom Street Railway Company; to build a five-mile line from Library road, Bethel township, Allegheny county, to the dividing line between Allegheny and Washington county, in St. Clair township; $28,500; directors: S. L. Tone, J. L. Foster, J. W. Stevenson, W. G. Whitlinger, W. B. Carson, Pittsburg. Bethel Street Railway Company; to build a line one and one-fourth miles long from the road in Bethel township, Allegheny county, to the old Washington road in the same township; $75,000; directors the same as the St. Clair & Sodom Company.

PERSONAL MENTION.

MR. J. A. HERRON, superintendent of the Bureau of Electricity, Pittsburg, Pa., has been removed, and Robert J. Daley has been appointed to the vacant place.

MR. H. E. MORTON, secretary and manager of the Boone (Iowa) Gas Company, has been appointed manager of the Fort Dodge (Iowa) Light and Power Company, and will take up the duties of this position on May 1.

MR. CHARLES A. BROWN, Chicago, Ill., on May 1 will remove his offices to 1550 Monadnock Block. With largely increased facilities, he will continue the practice of patent law in association with Lynn A. Williams, Charles J. Schmidt and Harvey L. Hanson.

MR. HARRY H. HORNSBY, conduit sales manager of the Sprague Electric Company, New York city, has recently returned to New York from a successful trip through the west and south. He reports business as very active and the outlook promising in those sections.

MR. WALTER T. FISHER, formerly president of the Municipal Voters' League, Chicago, Ill., has been appointed special traction counsel by Mayor Dunne, of Chicago. Mr. Fisher will receive a salary of $10,000 a year, and will devote virtually all of his time to the city's service.

MR. E. WARD WILKINS, of Partrick, Carter & Wilkins, Philadelphia, Pa., who is now making his annual visit to the Pacific coast, was fortunate in having left San Francisco for the north coast several days prior to the earthquake disaster. Mr. Wilkins is receiving congratulations on his good fortune.

MR. F. J. BOEHM has been appointed assistant secretary and treasurer of the Milwaukee Electric Railway and Light Company, succeeding the late George O. Wheatcroft. George W. Kalweit, bookkeeper, has been appointed auditor, succeeding Mr. Boehm. W. J. Ramsay, acting cashier, is also promoted to cashier.

MR. H. W. BUCK, the well-known electrical engineer and head of the electrical department of the Niagara Falls Power Company, will enter the service of the engineering firm of Viele, Cooper & Blackwell, New York city. Mr. Buck will also continue his connection with the Niagara Falls Power Company, making his headquarters in New York city.

MR. W. S. HOPKINS has resigned as general superintendent of the Columbus (Ohio) Railway anad Light Company, being succeeded by L. G. White, acting assistant superintendent. Mr. Hopkins, who is on his way home from Europe, will become chief engineer of the railway holdings of Clark & Company, Philadelphia, Pa., but will continue to make Columbus his headquarters.

MR. J. EPPS BROWN has been appointed general manager of the Southern Bell Telephone and Telegraph Company. The offices of vice-president and general manager will be separated, Colonel W. T. Gentry remaining in direct charge of the affairs of the company as vice-president. Mr. Brown began his telephone career in 1899 as manager of the Southern Bell exchange at Atlanta, Ga. When Colonel Gentry was elected general manager in 1901, he appointed Mr. Brown chief clerk. Later he was appointed special agent. In 1904, when Colonel Gentry was absent from the country, Mr. Brown was appointed acting general manager.

MR. SHELDON J. GLASS, secretary and treasurer of the American Light and Traction Company, will become vice-president and general manager of the company's subsidiary company in Milwaukee. Lanson P. Lathrop, vice-president and general manager of the Detroit City Gas Company, will take over the duties of vice-president and treasurer of the American Light and Traction Company. H. L. Doherty, general manager of the company, becomes a vice-president and consulting engineer. James M. McCarty, of the company's Quebec property, will be made a vice-president. James Lawrence is to become secretary and Marion McMillin assistant secretary.

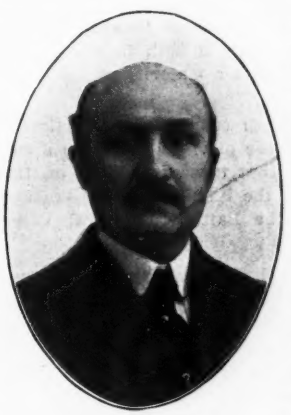
MR. ROBERT L. WEST, superintendent of the Georgia division of the Southern Bell Telephone and Telegraph Company, has resigned, after having served with the company, through various stages of promotion, for twenty-five years. He started with the company in Richmond, Va., and when nineteen years old was made manager of the Danville, Va., exchange. He later become manager at Charlotte, N. C., and was transferred back to Richmond. He stayed there as manager for two years, when he was sent to Birmingham, Ala., to take charge of that exchange, remaining there for six years. He was then promoted to the Atlanta, Ga., exchange as manager, holding that position for four years, when he was promoted to the superintendency of the Georgia division.

MR. JAMES RAWLE has been elected president of the J. G. Brill Company, succeeding the late G. Martin Brill. Up to the time of the latter's death Mr. Rawle was the treasurer of the company. The promotion of Mr. Rawle necessitated a general election of officers of the Brill company, resulting as follows: treasurer, Edward Brill; secretary, M. Herman Brill; assistant treasurer, Edward P. Rawle; vice-president, John A. Brill; general manager, Samuel P. Curwen; assistant secretary, William H. Heulings. Mr. Rawle is a Philadelphian and is a graduate of the University of Pennsylvania as a civil engineer in 1861. He was for many years in the service of the Pennsylvania Railroad, and entered the old firm of J. G. Brill & Son in 1872. M. Herman Brill, the new secretary, is the only son of the late president. Edward P. Rawle is a son of James Rawle, the new president.

MR. L. A. OSBORNE.

MR. L. A. OSBORNE was elected second vice-president of the Westinghouse Electric and Manufacturing Company on April 10, succeeding Mr. Frank H. Taylor, resigned. Mr. Osborne is a graduate of Cornell University, and became associated with the Westinghouse company in 1891. He has been in turn assistant superintendent, assistant to the vice-president, manager of works, fourth vice-president and third vice-president. As second vice-president he will assume the direction of the commercial activities of the company, while retaining the direction of the engineering department, the duties of which he performed as third vice-president.

MR. L. F. BOWER, formerly manager of the electrical works of the Allis-Chalmers Company in Cincinnati, Ohio, who was recently promoted to the position of controller of the company, has assumed the duties of his new office, with headquarters at Milwaukee. Mr. Bower was born and spent the early years of his life in Berwick, Pa. He attended the Wesleyan University, Middletown, Ct., graduating in 1879. For the five years following he was in the treasurer's office of the Jackson & Woodin Manufacturing Company, Berwick. He then spent three years in Carlisle, Pa., as principal of the preparatory department of Dickinson College. For one year he was managing partner of Mower & Mallory, chain manufacturers in Carlisle. He sold his interests to the Standard Chain Company, and for two years was superintendent of the car department of the Allison Manufacturing Company, Philadelphia. He left this concern on the death of Mr. Allison and for six years was manager and treasurer of the Carlisle Manufacturing Company, making freight cars, frogs, switches and vertical steam engines. He was secretary and treasurer of the Dickson Manufacturing Company, Scranton, Pa., from 1896 to 1901. When the machinery department of this company was absorbed by the Allis-Chalmers Company in 1901, Mr. Bower was retained as manager of the Scranton plant until 1904. On April 1 of that year he went to Cincinnati as secretary and treasurer of the company's electrical department, and in 1905 was appointed manager. While at Scranton Mr. Bower studied law and was admitted to the bar of Lackawanna county.



MR. L. F. BOWER.

TELEPHONE AND TELEGRAPH.

FARGO, N. D.—A telephone company has been organized at Oberon, with W. C. Schaffner president.

SHELDON, IOWA—The Western Electric Telephone Company has installed a new switchboard and made a number of improvements to its system.

FARGO, N. D.—The Red River Telephone Company's plant and franchise has been purchased by the Northwestern Telephone Exchange Company.

NORWICH, CT.—The contract for the new building to be erected by the Southern New England Telephone Company has been awarded, the price being about $16,000.

LOS ANGELES, CAL.—Important improvements and extensions have been planned by the Home telephone exchange at Monrovia, to accommodate the increasing business in that city. An appropriation of $10,500 has been made.

SALT LAKE CITY, UTAH—The Salt Lake office of the Western Union Telegraph Company is undergoing the process of a complete change in equipment. These improvements, which are nearly completed, will cost approximately $10,000.

ALTOONA, PA.—The Pennsylvania Telephone Company has absorbed the Saltillo Telephone Company, operating lines in Huntington county, and will consolidate it with its own lines. The Saltillo company has 100 telephones in service.

NEW ULM, MINN.—The New Ulm Rural Telephone Company, with lines radiating in all directions from New Ulm, has decided to build fifty miles of pole lines in addition to the present system. The switchboard will also be enlarged to accommodate nearly a thousand subscribers.

ELMIRA, N. Y.—A contract has been made whereby the companies centering in Millerton, Pa., consolidated for the purpose, will build a line from Millerton to state line for the purpose of there connecting with the York State line, opening direct communication with Elmira and other points.

HAMMONDSPORT, N. Y.—The Hammondsport Telephone Company has been granted a fifty-year franchise by the trustees of Hammondsport. A large number of subscribers to the system have already been secured and the work of wiring, together with the installation of an up-to-date central station, will at once be commenced.

GUTHRIE, OKLA.—The Western Oklahoma Telephone Extension Company, which operates throughout Roger Mills and adjoining counties, has been sold to the Pioneer Telephone Company, which now controls practically all the toll lines in both Oklahoma and Indian Territory, and the local systems in a majority of the towns and cities.

WEST CHESTER, PA.—The borough council of Avondale has granted the Bell Telephone Company the privilege of laying a conduit through the principal street of that town, and work on this will begin in the early spring. It is the intention of the management to connect all the towns of the Baltimore Central Valley with underground lines.

CANDOR, N. Y.—The Candor Telephone Company at its annual meeting elected the following officers for the ensuing year: president, P. C. Middaugh; vice-president, L. C. Burt; treasurer, H. D. Heath; secretary, E. D. Holly; directors, J. P. Fiebig, L. C. Burt, Thomas Pass, C. F. Gridley, J. W. McCarty, C. M. Jones, P. C. Middaugh, E. D. Holly, H. D. Heath.

WENATCHEE, WASH.—At the annual meeting of the Farmers' Telephone and Telegraph Company the officers elected were: president, Z. A. Lanham; vice-president, S. W. Phillips; treasurer, Arthur Gunn; secretary, H. C. Littlefield. The secretary's report showed that up to March 15 there were seventy-three miles of telephone lines owned by the company and 406 telephones in use.

CARLETON, MICH.—The People's Telephone Company, of Wayne, has elected officers as follows: president, Joseph Waltz, of Waltz; vice-president, E. C. Maxwell, of Carleton; second vice-president, Jesse Butler, of Willow; secretary and treasurer, Frank L. Edwards, of Carleton. Board of directors: T. J. A. Milliken, of New Boston; Joseph Waltz, of Waltz; Jesse Butler, of Willow; E. C. Maxwell, of Carleton; A. Reiser, of Wayne; F. L. Edwards, of Carleton.

MINNEOTA, MINN.—The citizens of Minneota have organized a stock company and will put in a local telephone exchange. The company will be incorporated with a capital stock of $5,000 and the city will be asked to grant a franchise. The officers of the new company are: president, G. B. Bjorson; secretary, F. C. Murray; treasurer, H. J. Tillemans; directors, C. K. Melby, Dr. H. J. MacKechnie, W. H. Deen and H. B. Gislason. The farmers of the township of Westerheim also have organized a company and will build a two-circuit line to Minneota.

DETROIT, MICH.—At the Michigan State Telephone annual meeting the old directors were reelected with the exception of Walter I. Mizner and William E. Thompson, who were succeeded by Truman Newberry, of Detroit, and F. A. Farran, of Boston. The old officers were reelected. The company is putting 100 miles of wire under ground, building two new exchanges, one in the extreme east and one in the extreme west portion of the city. It will build a new six-story building on the lot adjoining the present head offices, the same size as the present building, at a cost of $160,000.

NEW PUBLICATIONS.

HANDBOOK OF THE TORONTO BRANCH OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—The Toronto branch of the American Institute of Electrical Engineers has prepared a handbook giving the names of officers and a list of the members. This little book is very tastefully arranged and reflects credit upon the society.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS—The tenth annual report of the International Association of Municipal Electricians has been published. The frontispiece is a photograph of Mr. Jerry Murphy, Cleveland, Ohio, the president. In addition to the proceedings of the tenth annual convention there are a number of photographic reproductions of various prominent members of the association.

AMERICAN ELECTROCHEMICAL SOCIETY—Vol. viii of the transactions of the American Electrochemical Society has just been issued. This contains a report of the eighth general meeting, which was held at Bethlehem, Pa., September 18, 19 and 20, 1905. This volume gives all the papers and discussions in full. It also contains a frontispiece which is a reproduction from the pastel portrait of Professor Dr. Wilhelm Ostwald.

PROCEEDINGS OF THE OHIO ELECTRIC LIGHT ASSOCIATION—The proceedings of the eleventh annual meeting of the Ohio Electric Light Association, held at Put-in-Bay Island, Lake Erie, Ohio, August 16, 17 and 18, 1905, have been issued. Owing to numerous delays publication has been held up until this late day. The volume is replete with interesting papers and discussion, and the illustrations are particularly valuable. The present officers of the Ohio Electric Light Association are F. E. Valentine, Piqua, president; W. E. Russell, Massillon, vice-president; D. L. Gaskill, Greenville, secretary-treasurer.

TELEPHONE COMPETITION IN VARIOUS AMERICAN CITIES—The New York Telephone Company, 15 Dey street, New York city, has published an interesting booklet entitled "Telephone Competition in Various American Cities." This booklet presents an abstract from the minutes of the meeting of the Board of Estimate and Apportionment, of the city of New York, held on June 30, 1905. In addition to this there is a supplemental telephone report concerning a further inquiry into the effect of telephone competition. The figures given are instructive and interesting and the booklet is worth a very careful perusal.

THE AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION—The report of the twenty-fourth annual meeting of the American Street Railway Association has been issued. The frontispiece is a fine gravure of the Hon. W. Caryl Ely, president of the association. This report constitutes probably one of the most important publications of this society, containing as it does the complete record of the merger of the American Street Railway Association and the allied organizations into the American Street and Interurban Railway Association. A fine photogravure of T. C. Penington, who has retired after a long and honorable career as secretary-treasurer, also illuminates this volume.

EDUCATIONAL.

PURDUE UNIVERSITY—The annual catalogue of Purdue University, Lafayette, Ind., for the year 1905-1906 has been issued. This includes descriptions of the buildings and equipment, and the courses of study offered. There is also a register of students.

THE UNIVERSITY OF MINNESOTA—The February bulletin of the College of Engineering and the Mechanic Arts of the University of Minnesota has been received. This contains descriptions of the courses of study and instruction and much general information.

SUMMER COURSES AT THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY—A bulletin has been issued setting forth the summer courses for 1906 of the Massachusetts Institute of Technology. Instruction is offered during the months of June and July, supplementing the work of the regular school year. The summer courses are open also to persons not students in the institute, providing they possess the necessary qualifications.

APPOINTMENTS AT THE UNIVERSITY OF WISCONSIN—At a recent meeting of the regents of the University of Wisconsin, two important appointments to the faculty were made: Professor W. D. Pence, now head of the department of civil engineering at Purdue University, was elected to the chair of civil engineering, to fill the vacancy caused by the resignation of Professor W. D. Taylor, who has become chief engineer of the Chicago & Alton Railway. Dr. Edward B. Van Vleck, now professor of mathematics at Wesleyan University, was appointed to the professorship of mathematics, left vacant by the resignation of Professor C. A. Van Velzer.

WORCESTER POLYTECHNIC INSTITUTE—The Worcester Polytechnic Institute, Worcester, Mass., will erect a building this summer for the department of electrical engineering. This will contain a lecture room for experimental demonstration lectures capable of seating 300 persons, a standard laboratory, a department reading room and library with room for 2,000 volumes, an electrical engineering design room, photometric laboratory, telephone laboratory, and a general laboratory to contain most of the present equipment of the department. There will also be a laboratory for the study of high-tension phenomena, and an electric railway and engineering laboratory. It is hoped to have the building ready for use by the opening of the next college year.

NEW MANUFACTURING COMPANIES.

JEFFERSON CITY, MO.—The A. Riemann Electric Company has been incorporated by Anton Wind, George Riemann and Adam Riemann. The capital is $5,000.

MADISON, WIS.—The Wisconsin Brake and Electric Company has been incorporated with a capital of $5,000 by W. D. Hickman, J. A. McCormick and P. W. Boehm.

ALBANY, N. Y.—George Weiderman and T. H. Cooper, of Brooklyn, are directors of the New York Electric Controller Company, of New York city, just incorporated with the Secretary of State with a capital of $1,000.

BALTIMORE, MD.—The Manufacturers' Engineering Company, with a capital stock of $3,000, has been incorporated by Carl Von Hortz, S. Proctor Brady, F. Snowden Ehlen, T. Rowland Slingluff and R. Lee Slingluff, to manufacture, sell and deal in electrical and mechanical specialties.

ROCHESTER, N. Y.—Articles of incorporation of the John F. Malette Manufacturing Company have been filed with the secretary of state. The company, which is capitalized at $50,000, is to make and sell electrical devices. The directors are A. M. Malette, William Jacques and John F. Malette.

JERSEY CITY, N. J.—The American Hartung Battery Company has filed articles of incorporation, with a capital stock of $500,000, as general contractor and engineer, to do electrical construction work of all kinds. The incorporators are Gustave K. Hartung, New York; George H. Fagan, Arlington, and A. M. Lynch, Jersey City.

MARLBORO, MASS.—The Marlboro Equipment Company has been incorporated in Marlboro for the purpose of dealing in electrical goods. The capitalization is $3,000. Julius P. Watson, of Concord, is president; Herbert Smith, of Concord, treasurer and clerk, and Eugene W. Godfrey the remaining member of the board of directors.

ELECTRICAL SECURITIES.

The early week hopes that the spring bull movement was under way were badly shattered by the news of the disaster through earthquake and conflagration to the city of San Francisco. The evidence was also at hand of the very great interdependence of one financial centre upon another in the break of from three to twelve points which followed the early reports of the devastation. Although the full extent of the damage is not known as yet, the estimate of loss runs up to such magnitude that it is predicted that at least two or three of the insurance companies will suffer very greatly, with a consequent drain upon other resources. United Railroads stock, the street railway system of San Francisco, and other Pacific securities experienced severe declines. The latest developments in the controversy between the operators and coal miners are interpreted as foreshadowing an anthracite coal strike. The effect of this will be cumulative, and can not be predicted with any great accuracy at this time. The New York Central's annual report, with increases in both gross and net, and earnings of about 7.56 per cent on the stock, reflects the general condition of the larger railroads.

ELECTRICAL SECURITIES FOR WEEK ENDING APRIL 21.

New York:	*Closing.*
Allis-Chalmers common	21¼
Allis-Chalmers preferred	56⅛
Brooklyn Rapid Transit	84¼
Consolidated Gas	139⅛
General Electric	169
Interborough Rapid Transit	229
Kings County Electric	165
Mackay Companies (Postal Telegraph and Cables) common	62½
Mackay Companies (Postal Telegraph and Cables) preferred	72¾
Manhattan Elevated	154½
Metropolitan Street Railway	114½
New York & New Jersey Telephone	147
Western Union	92
Westinghouse Manufacturing Company	156

At the annual meeting of the Connecticut Railway and Lighting Company, held April 12 at Bridgeport, Conn., the following officers were reelected: president, A. M. Young; first vice-president, D. S. Plume; treasurer, Lewis Lillie; secretary, W. F. Douthirt; managing director, Walton Clark. The directors were also reelected. They are: A. M. Young, R. A. C. Smith, Louis N. Van Keuren, Randal Morgan, Walton Clark, H. G. Runkle, David S. Plume, Lewis Lillie, Allan W. Paige, M. J. Warner, J. E. Sewell. The common stock of the company is quoted at 55.

Boston:	*Closing.*
American Telephone and Telegraph	137½
Edison Electric Illuminating	248
Massachusetts Electric	67
New England Telephone	140
Western Telephone and Telegraph preferred	88

The instrument statement of the American Telephone and Telegraph Company for the month of March is as follows: output, 188,102; returned, 66,596; net output, 121,506. For the three months of the current year the gross output has been 526,484, and the returned 178,662, making a net output of 347,822. The total now outstanding is 6,046,080.

Philadelphia:	*Closing.*
Electric Company of America	11⅜
Electric Storage Battery common	76
Electric Storage Battery preferred	76
Philadelphia Electric	8⅛
Philadelphia Rapid Transit	27⅜
United Gas Improvement	93¼

A director of the Philadelphia Rapid Transit Company says the increase in gross earnings this year will show an increase to the end of April of $1,100,000. In the other two months of the fiscal year he estimates a further increase in gross earnings of $200,000, making $1,300,000 for the year.

Chicago:	*Closing.*
Chicago Telephone	110
Chicago Edison Light	153
Metropolitan Elevated preferred	68
National Carbon common	92
National Carbon preferred	121½
Union Traction common	7
Union Traction preferred	21

The preferred dividend of 1¾ per cent on National Carbon is payable May 15 to stockholders of record May 5. Books close May 5 and reopen May 16.

ELECTRIC RAILWAYS.

ELMIRA, N. Y.—A trolley line is to be built from Auburn to Port Byron this summer.

MARSHALLTOWN, IOWA—An electric interurban line to Ferguson or Haverhill is proposed.

BROOKLYN, N. Y.—The Brooklyn Rapid Transit Company will soon begin the construction of two new trolley lines between Bergen Beach and Manhattan *via* Williamsburg bridge.

RUSTON, LA.—The Ruston city council has granted a franchise for the operation of a street railway in Ruston. The proposed line will run to Chautauqua and the Lincoln Parish Fair Grounds, outside the city.

KANSAS CITY, KAN.—The Kansas City-Western Railway Company will spend one-half of a million dollars this year rebuilding the Kansas City-Leavenworth interurban line and the lines of street railway in the city of Leavenworth.

BRUNSWICK, ME.—The new directors of the Lewiston, Brunswick and Bath electric railroad, the control of which recently passed to a syndicate headed by John R. Graham, of Bangor, have voted $125,000 for improvements and extensions.

MILWAUKEE, WIS.—Several extensions to street car lines of the city of Milwaukee are planned by the Milwaukee Electric Railway and Light Company. Besides the extensions, improvements costing $150,000 will be made to the existing tracks.

SPRINGFIELD, ILL.—The secretary of state has issued a license to incorporate the Elgin & Dupage Electric Railroad Company, of Bloomingdale, to construct a road from River Forest, Cook county, through the counties of Cook, Dupage and Kane to Elgin.

GALVESTON, TEX.—The Galveston, Houston & Henderson, a fifty-mile terminal, extending from Galveston to Houston, Tex., may be equipped in the near future for the operation of electric passenger and express cars. It will cost $1,800,000 to make the change.

GLEASON, TENN.—A party of local capitalists, in conjunction with an eastern syndicate, is contemplating building an electric car line from Como, in Henry county, *via* Gleason, to Greenfield, in Weakley county. The proposed line will be nearly thirty miles in length.

CANON CITY, COLO.—The contract has been awarded for the grade of the Canon City, Florence & Royal Gorge Interurban Electric Railroad Company to William White, of Florence, from a point three miles west of Canon City to the top of the Royal Gorge, for $24,000, the work to be completed by July 1.

OWINGSVILLE, KY.—W. A. Young, state representative from Bath-Rowan district, states that work will begin at once on an electric line from Salt Lick, on the Chesapeake & Ohio railway, through Owingsville and Sharpsburg to Mt. Sterling, thirty-four miles. Philadelphia capitalists are behind the scheme.

WHEELING, W. VA.—The Dillonvale & Ohio River Traction Company will immediately commence the work of making the survey for its six miles of line between Dillonvale and Rayland. The company hopes to have its line in operation next fall, and as soon as the survey is made will commence to secure right of way.

WATERTOWN, WIS.—The Watertown city council has granted to the Wisconsin Light, Heat and Traction Company a fifty-year franchise for an electric interurban railway which will pass through from Milwaukee to Madison, and enter the city from the south, also making Watertown a junction point for two trolley lines.

TROY, N. Y.—At a meeting of the stockholders of the Forest Park Railway Company the capital stock was increased from $20,000 to $750,000, and the par value of the shares raised from $25 to $100. The increase is preliminary to the application to be made to the State Railroad Commission for an extension of the proposed route.

ALBANY, N. Y.—The Hudson Valley Railway Company has certified to the secretary of state that it has increased its capital by the issuance of $2,500,000 two per cent non-cumulative second income "B" debenture bonds of the company, convertible after two and not more than twelve years from date, into five per cent non-cumulative preferred stock of the company at par.

OKLAHOMA CITY, OKLA.—S. McCully, secretary and general manager of the proposed Lawton, Denton & Dallas electric railway, announces that the main line will be 150 miles long, but that the total track construction, including branches, will approximate 200 miles. The line is planned to run from Dallas to Lawton, *via* Denton.

NEW ALBANY, IND.—The Tennis Construction Company, which is building the extension of the Louisville & Northern Railway Company to Sellersburg, and is also building the branch of the Evansville, Newburg & Suburban Railway Company to Boonville, has taken the contract to construct the extension from Newburg to Rockport.

ROCKVILLE, CT.—Charles S. Mellen, president of the New York, New Haven & Hartford Railroad Company, announces that the proposed trolley road between Rockville and Stafford Springs, which recently passed into the hands of his company from the Shaw syndicate, of Boston, will surely be built, and that construction will begin as soon as many of the details can be finished.

WESTERLY, R. I.—The contract for the construction and overhead work on the Westerly & Connecticut electric road, an extension in Rhode Island of the Norwich & Westerly road, has been let to the National Construction and Equipment Company, of New York, the contractors who are putting in the Norwich road. The extension in Rhode Island is about three miles in length and will cost in the neighborhood of $75,000.

NEW IBERIA, LA.—The charter for the Bayou Teche Traction and Power Company, with a capital of $1,500,000, has been filed in the office of the district clerk. The company is to build a system of electric railways from New Iberia to Berwick, passing through the parishes of St. Martin, St. Mary and Iberia. It is expected that the work of construction will begin within sixty days. The domicile of the company is New Iberia. The capital is divided into 1,500 shares of $100 each, with $500,000 preferred stock.

DETROIT, MICH.—The Michigan United Railway Company has been incorporated to take over a number of electric lines in central Michigan. The lines to be taken over are the Lansing, Battle Creek and Kalamazoo city lines, and the interurban lines from Jackson to Kalamazoo and resort points and from Lansing to St. Johns. A total of 185 miles are in operation or under construction. The capitalization is $4,000,000 common and $1,000,000 preferred stock. The incorporators are the Moore-Elliott syndicate, of Port Huron, and their eastern financial backers.

NORWICH, CT.—The Norwich, Jewett City & Voluntown Street Railway Company has begun the construction of a trolley line between Norwich and Jewett City. The road will be the final link of a continuous electric line from Norwich, New London and Willimantic to Worcester and Boston. Construction operations have begun at the Jewett City end of the route. The road will prove to be an expensive one to build on account of the hilly character of the topography. The Norwich, Jewett City & Voluntown company is controlled by the Consolidated Railway Company, and it has an authorized capital stock of $700,000.

KALAMAZOO, MICH.—The annual meeting of the stockholders of the Grand Rapids & Kalamazoo Valley Traction Company was held in the company's offices recently, and the following directors were elected: E. J. Anderson, E. J. Henry, C. B. Kelsey, George Hefferan and W. H. Patterson. The officers of the board were elected as follows: president, W. H. Patterson; secretary, E. J. Anderson, and treasurer, C. B. Kelsey. The financial condition of the company is reported excellent, and the directors announce that the construction work will be pushed rapidly when the warm weather arrives. It is stated that the line will be built only to Otsego this year, but cars will be running between Kalamazoo and that place by July.

ENGINEERING SOCIETIES.

THE AMERICAN SOCIETY OF MODEL ENGINEERS—The American Society of Model Engineers held its first meeting at the Gilsey House, New York, on April 18. A considerable amount of work was successfully accomplished, and it was decided to hold the next meeting early in May. The following officers were elected: president, F. W. Geissenhainer; vice-president, E. B. Frank; secretary and treasurer, W. E. Spon, 123 Liberty street, New York city.

ELECTRIC LIGHTING.

SHATTUCK, OKLA.—Luther E. Reid will install a 1,500-light electric plant at Shattuck.

REDLANDS, CAL.—A movement has been started in Redlands to construct a municipal lighting plant.

GRAND ISLAND, NEB.—Grand Island has voted to issue $35,000 in bonds for the construction of a lighting plant.

CHESTER, N. Y.—The Orange and Rockland Electric Lighting Company is now lighting the village of Washingtonville.

LOCKPORT, N. Y.—The Lockport Gas and Electric Company has been granted the permission to change the present street lighting to modern enclosed arc lights.

BERRIEN SPRINGS, MICH.—A lighting contract has been entered into between the village of Berrien Springs and the Berrien Springs Power and Electric Company.

LITTLE FALLS, N. Y.—The Little Falls common council has granted a franchise to the Hudson River Electric Power Company to operate in the city for a period of fifty years.

WYTHEVILLE, VA.—F. P. McCready will establish an electric light plant and waterworks at Chilhowie. A two-story brick building will be erected at once. About $4,000 will be invested.

CANTON, OHIO—The board of county commissioners has granted to the Massillon Light, Heat and Power Company a right of way from Massillon to Canal Dover for the purpose of placing poles and wires to transmit electricity.

LOUISVILLE, KY.—The capacity of the plant of the Louisville Lighting Company will be increased fifty per cent within the next few months by the installation of new machinery. The company will expend not less than $300,000.

WINSTON-SALEM, N. C.—The Winston aldermen have passed a resolution authorizing the light committee to purchase at a reasonable price the plant of the Winston-Salem Gas and Lighting Company at the receiver's sale to be held shortly.

MASSILLON, OHIO—The board of public service has awarded a contract to the Massillon Light, Heat and Power Company to light the streets of Massillon for ten years at the rate of $69.50 per light per year, basing the contract on 160 lamps.

COVINGTON, KY.—The Covington board of council has passed the resolution reported from the board of aldermen providing for the employment of an electrical engineer to prepare plans and specifications for an electric plant of sufficient capacity to supply lights for the streets, alleys and public buildings.

EAST ST. LOUIS, ILL.—At a meeting of the city council in East St. Louis the franchise of the Interurban Transit Company, now the Illinois Illuminating Company, for a plant to furnish electricity for power and light in that city was revoked, and the company ordered to take down all wires and poles which it has erected.

CHETEK, WIS.—A twenty-year lighting franchise has been granted to W. J. Gairm, the plant to be in operation by January 1, 1907. The city may purchase the plant in ten years. The price of lighting is not to exceed $60 per year for arc lamps, or $15 per year for thirty-two-candle-power incandescent lights.

SHEPHERD, MICH.—The four counties of Isabella, Gratiot, Midland and Clare will be supplied with power and light from two plants, to be located on the Chippewa river. C. C. Field, of Shepherd, has procured options on two sites, where a head of from ten to twenty feet can be secured. It is estimated that at least 1,000 horse-power will be developed at each station. Work will begin in the spring.

PORTCHESTER, N. Y.—The Westchester Lighting Company has filed a certificate with the county clerk showing the election of the following new directors: W. R. Addicks, James C. Brady, H. E. Gawtry, Thomas E. Murray, John W. Sterling, F. A. Stratton, W. W. Scrugham, Harold Brown, R. A. Carter, W. E. Hall and L. L. Benedict.

WILMINGTON, DEL.—Within a short time the new Wilmington Heat, Light and Power Company will ask for bids for the construction of its power plant on the Brandywine in the Ninth ward. The power-house proper will be about 100 by 100 feet and will be constructed of concrete. The company will expend about $1,000,000 on the plant and equipment and will be ready for business in a few months.

BERKELEY, CAL.—The Berkeley town trustees have awarded the contract for the furnishing of light for the street lamps and for the town buildings to the Berkeley Electric Light Company at the rate of $6 per month per street lamp on an all-night schedule, and fifty cents for each interior lamp.

BELLINGHAM, WASH.—The Bellingham city council has entered into a contract with the Whatcom County Railway and Light Company to furnish lights for the city for a period of three years on a basis of 150 arc lights, at $4.50 per month per light. Incandescent lights at the city hall and fire hall are to be furnished free.

SPOKANE, WASH.—Jay P. Graves has paid $77,000 for the falls of the Columbia river at Kettle Falls, seventy-five miles north of Spokane. The river there can produce 100,000 horse-power of electricity at extreme low water, and the falls are said to be the largest in the United States with the exception of Niagara and the Shoshone. Mr. Graves is expected to install an immense electrical generating plant to supply his Inland Empire Electric Railway radiating from Spokane, and also the mines and smelters in the boundary district of British Columbia.

MICHIGAN CITY, IND.—A contract has been entered into between the city of Michigan City and the Michigan City Light and Power Company whereby the franchise now held by the Michigan City Electric Company is extended a period of twenty-five years from May 1, 1906, or eighteen years from the date of expiration of the present franchise. The Michigan City Light and Power Company was granted the right to construct, own, hold and operate an electric system for heating, lighting, power and other commercial purposes within the limits of the city.

EASTON, PA.—At the annual meeting of the stockholders of the Easton Gas and Electric Company the following directors were elected: Uzal H. McCarter, F. W. Edgar, S. L. Shober, Jr., H. E. Mitchell, J. Madison Porter, Frederick R. Drake, H. A. Doan, T. W. Cramp, B. F. Cresson, S. C. Smith, E. J. Fox, Chester Snyder, A. D. Chidsey, W. J. Daub and F. S. Bixler. The directors organized by electing the following officers: President, Chester Snyder; first vice-president, Frederick R. Drake; second vice-president, S. L. Shober, Jr.; secretary and treasurer, B. F. Cresson.

SANTA CRUZ, CAL.—The Big Creek Power Company, which practically controls electric power in Santa Cruz county, has been sold to John Martin and Eugene de Sabla, Jr., of San Francisco, of the Pacific Gas and Electric Company. Martin and de Sabla recently purchased the Santa Cruz Electric Light and Power Company, which takes power from the Big Creek company, and followed it up a few weeks later by purchasing the Cooperative Electric Light Company, a local concern which makes its own light. The price paid for the Big Creek company is believed to be in the neighborhood of $300,000.

NORTH ABINGTON, MASS.—Stone & Webster, of Boston, have assumed control of the Electric Light and Power Company, of Abington and Rockland. L. A. Crossett, M. N. Arnold, E. P. Torrey and George A. Beal resigned as members of the board of directors. Guy E. Tripp, Charles F. Willis, Dwight P. Robinson, Henry G. Bradley and Frederick S. Pratt, of Boston, were elected to fill the vacancies. Lot Phillips, George W. Kelley, James W. Spence and J. L. Greenwood were continued as directors. Organization was effected by the choice of Frederick S. Pratt, of Boston, as president. The company will be continued under the name of the Electric Light and Power Company of Abington and Rockland for the present at least. The plant and system will be improved and enlarged, and the service may be extended to West Hanover.

OBITUARY NOTICE.

MR. GEORGE W. STOCKLY died on April 19 at Atlantic City, N. J. He was sixty-two years old and his home was at Lakewood, N. J., although he spent part of his time at Cleveland, Ohio, and Charleston, W. Va. He had extensive timber and milling interests in West Virginia. For many years he was engaged in the banking business in Cleveland, later organizing the Telegraph Supply Company, and later still being associated with the organization of the Brush Electric Company and the Chemical Supply Company, of which he became president and director. He was also a president and director of the Devereaux Lumber Company, and belonged to the Lawyers' Club, New York city.

INDUSTRIAL ITEMS.

THE AITON MACHINE COMPANY, Harrison, N. J., will be pleased to send its recent bulletin concerning new forms of armoring machines.

THE BUCKEYE ELECTRIC COMPANY, Cleveland, Ohio, is distributing a folder calling attention to the varied uses of the Buckeye incandescent lamps. This folder will undoubtedly attract a great deal of attention.

THE PURCHASERS' GUIDES, Oswego, N. Y., is asking for catalogues descriptive of all classes of electrical supplies. The New York office is at 150 Nassau street and the Chicago office at 277 Dearborn street.

THE CALCULAGRAPH COMPANY, New York city, has published a neat folder entitled "Getting Out of the Rut." This company will be pleased to send its literature to any one interested in time-saving appliances upon request.

THE NEWTON MACHINE TOOL WORKS, Philadelphia, Pa., in catalogue No. 43 describes and illustrates cold saw cutting-off machines. In addition to the machines for belt driving the catalogue shows several forms of motor applications.

THE CONSOLIDATED LAMP AND GLASS COMPANY, New York city, announces its removal on May 1 to No. 19 Murray street. The company's line of 1906-07 lamps, shades and globes is now ready for inspection. Mr. Edward H. Mays is eastern manager.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., is mailing a series of fifty multichrome cards giving views of Swiss scenery, as part of an advertising campaign to call attention to the Schindler bolting cloth which the company furnishes to millers.

THE NILES-BEMENT-POND COMPANY, New York city, will be pleased to send on application a new catalogue descriptive of outdoor cranes. This takes up the matter of Niles electric traveling cranes for use in stone yards, freight yards, lumber yards and storage yards.

THE NATIONAL FIREPROOFING COMPANY, Pittsburg, Pa., has published a very attractive booklet entitled "The City Unburnable." This book details the erection of fireproof buildings. The illustrations are very good and the text is of decided interest at this time.

THE WELLMAN-SEAVER-MORGAN COMPANY, Cleveland, Ohio, has published a new catalogue descriptive of standard and special electric hoists. This catalogue, in addition to a number of fine half-tones, contains careful descriptions of the apparatus and lists of weights and sizes.

THE ELECTRICAL TESTING LABORATORIES, Eightieth street and East End avenue, New York city, is distributing a reprint in booklet form of a paper by Dr. Clayton H. Sharp, entitled "A Testing Laboratory in Practical Operation," presented at the 201st meeting of the American Institute of Electrical Engineers.

THE INDIA RUBBER AND GUTTA PERCHA INSULATING COMPANY, New York city, announces the removal of its offices on May 1 to the Postal Building, 253 Broadway. Mr. James B. Olson, the well-known manager of sales, will have increased facilities for promptly attending to this company's large interests.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, Pa., has ready for distribution an instruction book for the care of "Exide" batteries in electric vehicles. This instruction book should be in the possession of every one who makes use of storage batteries for vehicles and is interested in the process of charging and maintaining the batteries.

THE STANLEY-G. I. ELECTRIC MANUFACTURING COMPANY, Pittsfield, Mass., in bulletin No. 603 describes carbon-break circuit-breakers. In addition to the illustrations of the apparatus there are given a number of diagrams of connections and detailed descriptions of the various parts. These circuit-breakers have a capacity of from fifteen to 10,000 amperes.

THE SPRAGUE ELECTRIC COMPANY, 527-531 West Thirty-fourth street, New York city, has ready for distribution its catalogue of electric fans for 1906. This catalogue shows the usual handsome line of fans of the direct-current type. In addition to this the company is listing a line of high-class alternating-current electric fans of both desk and bracket types. The catalogue is handsomely printed in two colors, the illustrations and text being very complete.

THE MARINE ENGINE AND MACHINE COMPANY, 126 Liberty street, New York city, has been awarded the contract for the elevator equipment for the new Brunswick building, at Twenty-sixth street, Broadway and Fifth avenue, New York city. There will be eleven electric elevators. The building is to be twelve stories high, and is to be used as a high-class office building. The builder is Charles T. Wills, 156 Fifth avenue, and the architect, Francis H. Kimball, 71 Broadway.

THE STANDARD CHEMICAL COMPANY, Cincinnati, Ohio, is meeting with a very satisfactory demand for its "Imperial" soldering stick. This stick is the result of considerable experimenting to secure a perfect flux. There is no acid used in the make-up of this stick, and it is stated that it will not corrode, at the same time being quick-acting. It is strong and durable and is put up in rigid boxes to withstand rough handling. The stick is clean to handle and does not soil the hands, and in soldering there is no dirt left in the spelter.

THE BRUNSWICK REFRIGERATING COMPANY, New Brunswick, N. J., builder of the Brunswick refrigerating and ice-making machinery, has published a new catalogue descriptive of hygienic ice-making and sanitary refrigeration. In addition to the matter descriptive of the ice-making and refrigerating apparatus there is considerable information of value concerning cold storage and low temperatures. A larger catalogue descriptive of machinery for refrigerating and ice-making is replete with interesting literature on this subject and is well illustrated, showing several forms of compressors and automatic portable refrigerating outfits.

THE C. E. HEWITT COMPANY, New York city, announces that by an agreement just completed its entire business interests will be merged in a new corporation to be known as the Stevens-Hewitt Engineering Company, which will continue the business as heretofore, and will take over all existing contracts and liabilities of the C. E. Hewitt Company. All the members of the C. E. Hewitt Company will go into the Stevens-Hewitt Engineering Company, and the company will be strengthened by enlargements to its technical staff, including the well-known engineers, Edwin A. Stevens, of Hoboken, N. J., and Irving Cox, of New York city.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., is bringing to the attention of construction men the "Western Union" standard steel cross-arm pin, for which it is the general western selling agent. This pin has been adopted as a standard by the Western Union and Postal Telegraph companies, and is made according to their specifications. A highly carbonized steel is used, ensuring great stiffness and strength. This is very important, especially during storm periods, when great damage is often done through the breaking off or pulling out of wooden pins. Another point in favor of this pin is that it requires only a half-inch hole bored in the cross-arm, as against a one-and-one-half-inch hole for the wooden pin. The Central Electric Company will be pleased to have construction men write for prices and information concerning these pins.

THE BISHOP GUTTA PERCHA COMPANY, 420-430 East Twenty-fifth street, New York city, at a meeting of the directors held on April 18, received the resignation from the office of treasurer of Mr. Henry A. Reed. Mr. Reed's eldest son, William Boardman Reed, was elected as his successor and H. D. Reed was elected vice-president. The business has increased so much recently that during the last three years the factory capacity has been augmented fifty per cent. It is intended to add a new building of five stories with a ground area of fifty feet by 100 feet to the present factory, thus making another fifty per cent addition. Mr. Henry A. Reed remains the president of the company, and in this, the seventy-eighth year of his age, has completed twenty-seven years' work for this enterprise. He entered the electrical field, as a telegrapher, in 1849, and this month completes his fifty-seventh year in the electrical business.